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VIEWS, NEWS AND INTERVIEWS.

Professor Langley of the Smithsonian Institution, as related in the report of the Institution for the year ending June, 1893, has brought his bolometer to a state of high perfection. This instrument, in theory extremely simple, is a fine wire through which a current of electricity is kept flowing. The resistance of the wire varies with the temperature, and, hence, the strength of the current also varies. By measuring the current, therefore, the temperature of the wire can be ascertained. As is well known, Professor Langley has explored the invisible regions of the solar spectrum with this device, proving by it that in them, as well as in the luminous portions, fine absorption lines exist. In this and in other fields it has easily taken a place as one of the most valuable of existing physical instruments. In the latest and most delicate form the wire is $\frac{1}{250}$ inch wide and $\frac{1}{2500}$ inch thick, and a difference of temperature amounting to $\frac{1}{100000}$ degree Centigrade can be perceived.

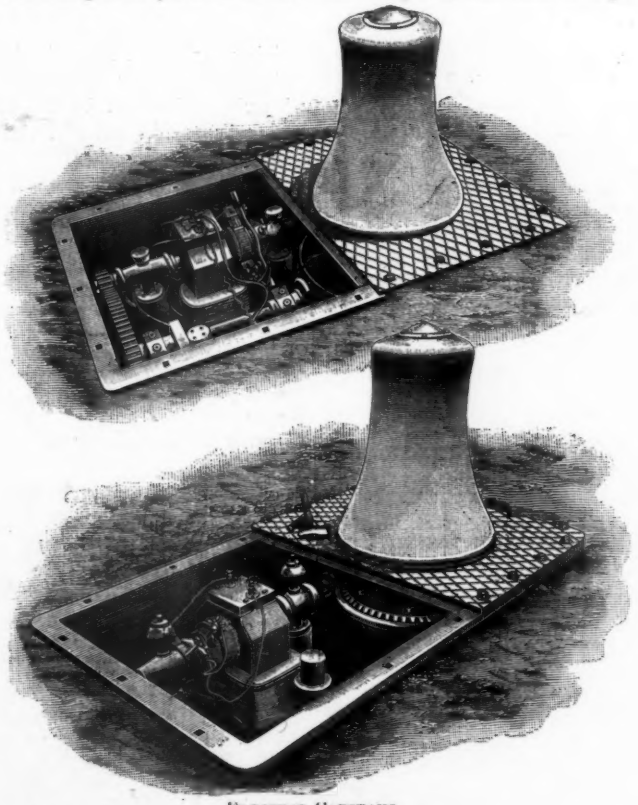
It is reported that a Frenchman has invented an electric mosquito bar which electrocutes insects which come in contact with it.

The change made by electricity in the roads operated by the Brooklyn Traction Company is very marked, as is shown by the reports for the quarter ended on March 31, filed last week with the Railroad Commissioners. This was the first quarter in which the entire system was operated by the trolley for the full time. Although it was the poorest quarter of the year, the system showed a surplus of $3,791 as against a deficiency of $50,434 for the same time last year. Taking the two companies in the system separately the Atlantic avenue roads showed gross earnings of $45,000 more than last year, while the operating expenses were $36,000 less. The net earnings from operations were $71,000 in excess of the deficit of last year. Rent also decreased $5,000 and fixed charges increased $25,000, making the surplus $15,912 or $40,597 more than last year's deficiency. The gross earnings of the West End road were $1,200 less than for the same quarter in 1893. The operating expenses, however, were reduced nearly 50 per cent or £14,000. The deficit for the quarter was $13,628 less or $12,121 against $25,749 last year. The balance sheet of the two companies show the floating debt reduced to $161,780.

M. F. Walter has found that an alloy consisting of 95 parts of tin and five parts of copper adheres so tenaciously to glass, that it may be employed as a solder to join the ends of glass tubes. It is obtained, according to the *Revue Scientifique*, by adding copper to the tin previously melted, agitating with a wooden stirrer, casting or granulating and then re-melting. It melts at about 360 degrees C. By adding from a half to one per cent of lead or zinc, the alloy may be rendered either softer or harder, or more or less easily fusible. It may also be used for silvering metals or metallic thread.

Electric Capstans.

The illustrations on this page, for which we are indebted to London *Engineering*, represent two electric capstans constructed by Messrs. Humpidge and Snoxell, Limited, Dudbridge, Stroud, Gloucestershire, and differing in the type of gearing adopted. Both are in daily requisition, moving coal trucks, etc., empty and loaded, to and from various parts of the yards, and each is capable of hauling two loaded 10-ton wagons round the ordinary curves and gradients at a speed of about two and one-half miles an hour. The working parts are contained in a water-tight iron casing below the ground level, access to the motors being readily obtained by means of a small cover provided for that purpose. The motors were made by Messrs. Crompton & Company, of Chelmsford. They are compound wound, and take, in regular work, a current of 45 amperes at 110 volts pressure; but will pass a good deal more current at starting for a short time without injury. The leads are brought to the capstans in a two inch wrought iron pipe laid underground; and the starting switch is arranged so that the current is applied gradually so as to start the motor without undue shock. In the one case the motor drives the hauling head by means of ordinary machine-cut spur gearing, with a compressed raw-hide pinion on the motor spindle. In the other capstan this arrangement was modified and the motor is geared direct into the capstan head spindle by means of a worm and wheel. The greatest care was taken to make this latter arrangement as effective as possible; the worm was made of hard tool steel, double-threaded and provided with a proper collared thrust bearing. The worm-wheel was made of phosphor bronze, accurately shaped to the worm, and the whole arrangement worked in an oil bath. The efficiency, although high, was found to be slightly lower than in the case of the capstan with the spur gearing.



ELECTRIC CAPSTANS.

The first capstan has been in daily use since May 25, 1891, and is probably the first electric capstan ever started in regular work. It has advantages over a capstan worked by water pressure, principally on the score of economy of working. The current taken is directly in proportion to the work which is being done, whereas with an hydraulic capstan the full amount of water is passed, whether any work is being done or not.

Twenty creditors of the Fostoria, O., Light and Power Company met last week with ex-Secretary Charles Foster and Assignee Harris. The creditors proposed to take the plant and assume the liabilities, which was finally accepted. They propose to greatly enlarge and improve the plant and add an incandescent system to it. Mr. Fostor has been trying for some time to come to an agreement with the creditors to issue bonds to them for the amount of their indebtedness and float additional bonds to secure working capital, but failed.

TEXTILE MANUFACTURING BY ELECTRIC POWER.

AN INTERESTING INSTALLATION AT TAFTVILLE, CONN.

The first important application of electrical power transmission to textile manufacture has just been installed by the General Electric Company, at Taftville, Conn., the power being transmitted from Baltic to Taftville, a distance of nearly four and one-half miles. It is a typical transmission by three phase currents, in which motors of the synchronous type are used not only to operate one of the most interesting cotton mills in this country, but also the power station of the Norwich, Conn., street railway.

FIG. 1.—BALTIC MILLS, SHOWING RESERVOIR AND INTAKE GATES.

Mr. E. P. Taft, the progressive founder of the Taftville cotton industry, long ago recognized the value of the available water-power at Baltic, on the Shetugket river, near to which stood a ruined mill destroyed by fire some years ago, and, having secured the property with the water rights, determined to utilize the power as soon as a successful means could be discovered. When the General Electric Company announced a practical solution of the power transmission problem, Mr. Taft carefully investigated the system and finally decided to adopt it for the operation of his cotton mills.

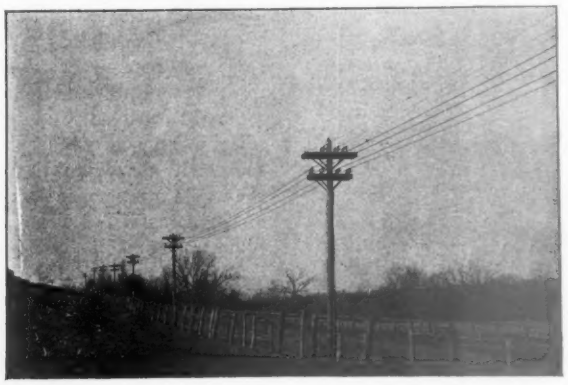


FIG. 2.—TAFTVILLE TRANSMISSION PLANT POLE LINES.

The Ponemah Mills are situated at Taftville, also on the Shetugket, and about three miles distant from Norwich. The original mill was operated for nearly a score of years by water-power taken directly from the river, and when the new mill was erected it was found necessary to drive it from two 350 horse-power Corliss engines, the existing dam being insufficient in capacity. In these mills are manufactured, perhaps, the finest and most delicate cotton fabrics produced in this country. All manner of fancy weaves for special purposes form the regular output of this mill and the exceptional quality of the goods has kept the plant steadily at work during the dull times, even when cotton mills all over the country have been shut down. The line is nearly four and one-half miles in length and is carried along the highway up the river, skirting its bank in places and crossing it at intervals to shorten its route.

The rebuilt mill at Baltic is shown in Fig. 1. In the basement of this building are the wheel and dynamo rooms of the generating plant. The mill is of four stories, built of stone, and will presently be used, as the Ponemah Mills, in the cotton weaving industry. Four hundred feet above the mill a fine stone dam 525 feet long has been thrown across the river. The effective head on the turbines is 32 feet and the water available, even in the dryest seasons, is sufficient to furnish not less than 1,500 horse-power.

The turbines are belted to pulleys on the line shaft extending the whole length of the wheel room and continuing through the partition walls into and along one side of the generator room. The pulleys are thrown into, or out of, action by Hunter clutches mounted with pulleys on quills, so that any or all of the wheels can be applied to driving the shafts. Similar pulleys and clutches are furnished in the dynamo rooms for throwing in or out the various machines that may there be placed.

Fig. 3 shows the wheel-room and the arrangement of the turbines and line shaft. There are three double 42 inch horizontal wheels and one double 27 inch wheel, the former developing 800 effective horse-power each, at 157 revolutions per minute, and the latter 300 horse-power at 244 revolutions per minute. The belts pass obliquely upward to the pulleys on the line shaft, and the turbines are kept at speed by Schenck electric governors, which have proved themselves capable of doing very fair service. The wheel plant and shafting were made and installed by the P. C. Home Company, of Gardiner, Maine. The line shafting is supported by heavy iron girders set on stone piers and additionally braced by timbers.

The dynamo room, Fig. 5, beside the shafting is occupied by two 250 kilowatt General Electric three phase generators, delivering current to the line at 2,500 volts. Each machine is provided with its own exciter, a three kilowatt bipolar dynamo. The three phase machines run at 600 revolutions per minute, and are set so firmly on substantial foundations as to run with scarcely a perceptible vibration. The driving pulleys on the main shaft are fitted with Hunter clutches, so that either machine can be dropped out without the slightest disturbance to the service.

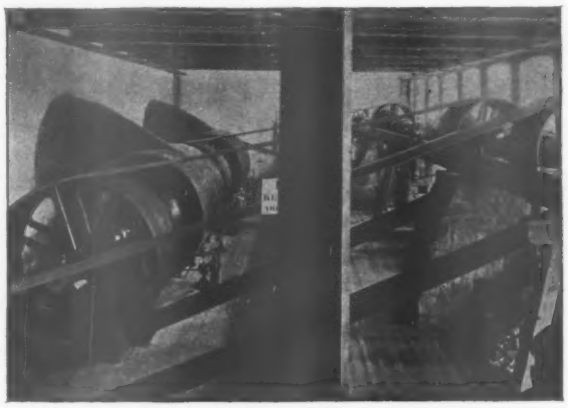


FIG. 3.—TURBINE ROOM.

The generators are connected to a common switchboard, Fig. 4, and may be run in parallel whenever desirable. To this end the board is furnished with synchronizing apparatus, the acoustic synchronizer being mounted on the face of the switchboard, and the equalizing switch being at the back. The most interesting novelties on this switchboard are the high voltage switches on the lower part of the board. These are mounted on marble bases with substantial barriers erected between the switch-blades, so that the circuit at full load and voltage may be broken without the slightest danger of arcing across from point to point. They have been amply tested and have proved their ability to cope with the trying work required of them with the greatest ease.

The generators fall into parallel easily and run as smoothly together as would a couple of railway generators. No artificial load is used in throwing them together, none having proved necessary.

The line, a characteristic bit of which is shown in Fig. 2, is a good piece of construction work on substantial wooden poles placed 100 feet apart. The upper wires on the cross arms are of No. 0 bare copper and form the original three phase circuit designed for the transmission. The wires on the lower cross-arm are No. 0000 insulated wire, and are four in number. They were originally intended for a railroad circuit, the generators for which were to be installed at Baltic to feed the Norwich Street Railway; but as the amount of copper necessary to do the work successfully appeared too great, the system was changed, a second three phase generator and motor were added, and three of the four proposed feeder wires were utilized for the three phase circuit. All are supported on the General Electric Company's standard oil insulator, the fourth No. 0000 wire forming a convenient relay in case of accident to any of the others.

At Taftville the three phase circuits are led into the basement of the new mill, where they drive two three phase synchronous self-starting motors, Fig. 6, identical in size with the generators at Baltic. These machines replace the two Corliss engines previously used. One motor, with its switchboard, is shown in Fig. 6, which also gives an excellent view of the high voltage switch before referred to. These motors are belted to the jack shafting previously driven by the engine, the pulleys on the shaft being equipped with friction clutches so that the load can be

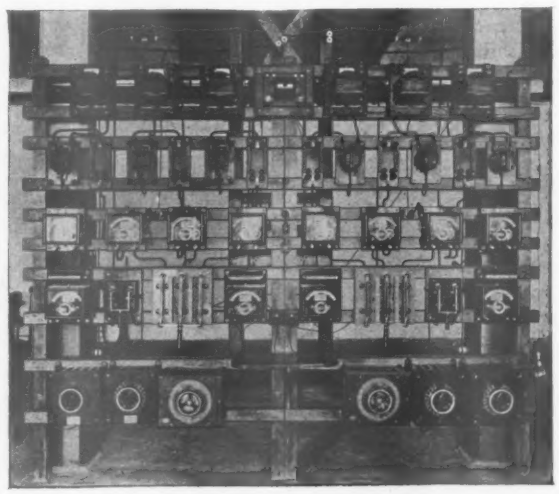


FIG. 4.—SWITCHBOARD IN BALTIC MILLS.

thrown from engine to motor, or back again, without any interruption of service.

The motors start entirely unaided, coming up to synchronous speed in about 50 seconds from the time the current is thrown on. They are, like the generators, separately excited, the exciters being driven from the pulleys on the end of the motor shaft.

The efficiency of the complete transmission at full load, from the

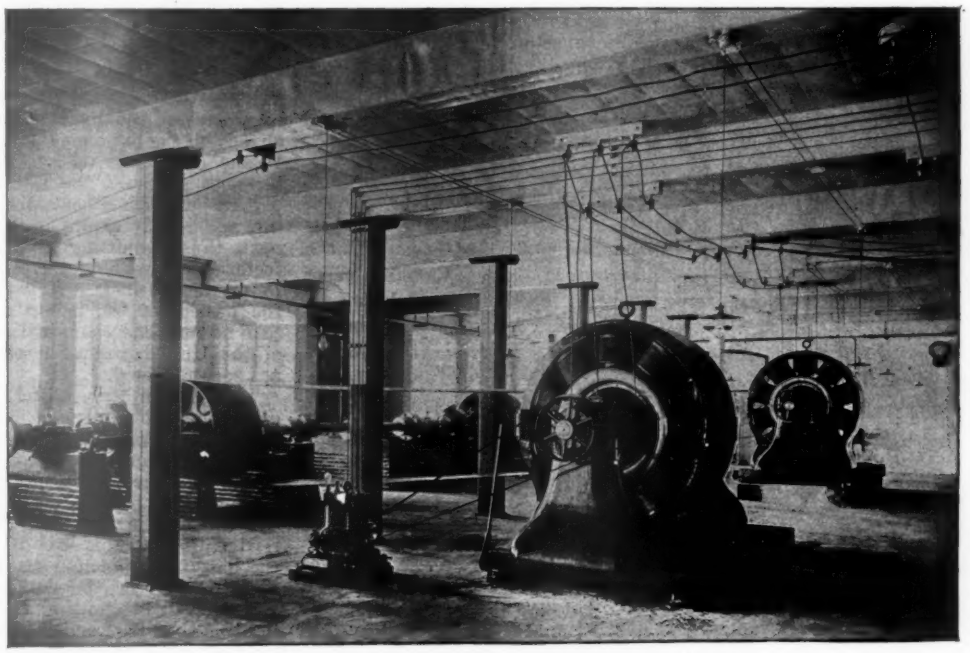


Fig 5.—Generator Room, Baltic Mills.

power applied to the dynamo pulley to that delivered to the motor pulley, is reported to be just at present 80 per cent. In originally starting the mill before the second motor was ready for operation, it was the custom to bring the motor up to speed, and then gradually throw in the clutch connecting it to the shafting already running from one of the engines. When the clutch was fully in and engine and motor running together, the engine was disconnected by its clutch and the power transferred entirely to the motor. This could be done without producing the slightest disturbance in the speed, and in the same way, now that both motors are in and the engines shut down, the load can be shifted from one motor to the other if desirable. Ordinarily, however, there is work enough for both, when driving the 1,700 looms in the new mill, operating the lighting plant and the three 80 horse-power General Electric railway generators, installed in another part of the basement.

The first motor was started more than two months ago and—the complete plant entirely installed by the power and mining department of the General Electric Company—has now been in operation for several weeks, entirely displacing the steam service and performing its duties in a highly satisfactory manner. It is already attracting great attention among cotton manufacturers.

PERSONAL.

Mr. Wm. H. McKinlock, president of the Metropolitan Electric Company, Chicago, was in New York last week.

Mr. Henry M. Whitney last week denied that he intended to resign from the directory of the West End Street Railway Company, of Boston.

The suit of the W. J. Johnston Company, Limited, *vs.* W. T. Hunt and the Electrical Age Publishing Company, came up on appeal at Albany, N. Y., on April 10. The previous judgment in favor of the defendants was affirmed with costs.

Col. Henry C. Davis, well known in the electrical field, has been elected president of the State Line and Sullivan, Pa., Railroad Company, and the Barclay, Pa., Railroad Company, both of which roads are tributary to the Lehigh Valley system. Mr. Davis will make his headquarters in Philadelphia.

A Shrine Badge for W. J. Clark.

At a meeting of the salesmen of the central district of the General Electric Company, held in Cincinnati on Tuesday evening, the 24th inst., and at a farewell supper given by Mr. W. J. Clark prior to his departure for New York city, where he assumes the general managership of the railway department of the General Electric Company, he was presented with a beautiful "shrine" badge by his employés as a slight token of their regard and esteem and for the treatment received by all connected with the office during his management. Messrs. H. H. Corson of the Nashville office, Leon Cooper from Louisville, and Col. W. A. Sheldon and

Mr. Herbert H. Holding, of the engineering department of the General Electric Company, and located at the Cleveland office, was married on Wednesday, the 25th inst., to Miss Sarah Belle Ausherman at Terre Haute, Ind. The numerous friends of Mr. Holding in the East will no doubt read with pleasure the announcement of his marriage.

Fig. 6.—Synchronous Motor, Basement, Ponemah Mills.

A complimentary banquet was given at the Holland House, New York city, last week in honor of Mr. George Edward Harding, the architect of the new Postal Telegraph-Cable Company's building. Among the electrical men present were Albert B. Chandler, Wm. H. Baker, Theodore L. Cuyler, John M. Pendleton, and Francis W. Jones.

F. H. Bostwick of the Cleveland office were the out-of-town guests. During the meeting, the appointment of W. F. Hays, who for some time has been assistant to Mr. Clark, to the position of acting manager was announced by telegram from the home offices in New York. John B. Pevear will act as assistant to Mr. Hays.

AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

ARRANGEMENTS FOR THE PHILADELPHIA MEETING.

The Philadelphia local committee is making elaborate arrangements for the entertainment of members of the Institute who attend the coming annual and general meetings in that city. The social features are being especially arranged with regard to the attendance of ladies, and it is hoped that the fair sex will be well represented. This being the tenth anniversary of the Institute, the rule of strict attention to business will necessarily be relaxed somewhat, in order that members and guests may avail themselves of the proverbial hospitality of the City of Brotherly Love. In addition to the list of papers published last week, Dr. Louis Bell will present one upon "Some Facts About Polyphase Motors."

A brief outline of the preparations in progress prepared by Chairman Willyoung of the local committee embraces the following functions:

On Tuesday, May 15, address of welcome by Mayor Stuart, to be followed by the annual business meeting and reading of papers. Mr. Wurts' paper on "Lightning Arresters" will be accompanied by experimental demonstrations at the station of the Philadelphia Traction Company. In the evening the annual dinner of the Institute and a theatre party for the ladies.

Wednesday afternoon, a tally-ho excursion will be provided for the ladies and the Engineers' Club will tender a reception in the evening.

Thursday afternoon will be occupied by a visit to Cramp's ship yard, followed by a steamer trip down the river to Gloucester, where a shad dinner will be served.

Fuller details of the arrangements will be given in the official programme. Visiting members will be welcome to the office facilities of Messrs. Houston and Kennelly, Rooms 1105 and 1106 Betz building, near the Pennsylvania railroad station, where letters may be addressed in advance of their arrival.

The secretary of the Institute would deem it a favor if those who propose attending the meeting will write him to that effect at 12 West Thirty-first street, New York city.

ELECTRICITY AS APPLIED TO ST. ETIENNE, FRANCE, INDUSTRIES.

REPORT BY CONSUL CHARLES W. WHILEY, JR.

St. Etienne may well be called a workingman's town. Fully three-fourths of its 133,000 inhabitants derive their support from the mine, the gun factory, the foundry and the loom. Of this large body of wage-earners by far the most intelligent are the weavers, numbering about 30,000. Of the 18,000 looms in St. Etienne, the greater number are owned by the individual weavers and worked by hand in their own homes. While it is apparent that the recent inventions for the transmission of power by electricity will shortly effect an alteration in the methods, it is not thought that it will change to any great extent, at least, the location of the work.

Until very recently the ribbon-weaver, laboring in his own home, could see no room for improvement in the mechanical execution of his work. From time immemorial the long bar had been worked by hand. Brought up to it from childhood, and inheriting the prejudices of his class, it was difficult to convince this member of an ancient guild that any advantage could be gained by the substitution of any other power for that of his own sinewy arm. Of late, however, his eyes have been open to the wonders of that subtle agent which is so rapidly transforming the mechanical work of the world, and to-day it is not a rare occurrence to find a humble weaver who can talk to you of dynamos and motors with the intelligence of a practical electrician. Already over 60 looms are being worked by electricity, the force being furnished by the Edison Electric Company. This company has for several years supplied the light to a large number of shops, hotels and saloons in the city, but more recently, with commendable enterprise, it has undertaken to furnish electric force to the numerous looms in the district. To this end it has established an elaborate electric plant on the river Loire, at the foot of a picturesque village, St. Victor-sur-Loire, situated about eight miles from St. Etienne. A waterfall of 900 horse-power sets in motion three turbines which transmit the electric force through four cables, seven millimeters in thickness, to its destination. As has been stated, over 60 looms are now in operation, worked by electricity furnished by this company, and the director informs me that he anticipates a great increase in the number during the next six months.

Just now the ribbon business is extremely dull, but it is confidently expected that with the revival of trade every loom owner will wish to take advantage of this mechanical force. The actual expense under this system is 350 francs per loom, including dynamo, pulleys, belts, etc., all of which become the property of the weaver. An additional sum of 10 francs per month is charged for each loom. If the loom remains idle for more than a fortnight in any one month, a proportionate deduction is made by the company. A weaver who is the owner of two looms driven by electricity recently told me that by this agency he can turn out 25 per cent more work than formerly.

The large ribbon factories of St. Etienne are, as a rule, worked by steam power. There is one factory, however, that of Messrs. Forest & Company, which is worked entirely by electricity. In this factory,

FIG. 1.—WESTINGHOUSE SERIES-MULTIPLE RAILWAY CONTROLLER.

which is of recent construction, there are 100 looms for the manufacture of the various styles of ribbons—silk, velvet, fancy ribbons, etc.—and a number of others for the making of plush. All these looms are worked by electricity, furnished by two powerful dynamos situated on the ground floor, and put in motion by a large steam engine. Each loom has its own accumulator, regulating the velocity according to the article manufactured, and when it is stopped the current is turned off, so that no waste of electric power is allowed. This saving of expense can be readily appreciated, as it is well known that the weaver, for one reason or another, has to stop his loom very frequently during the day.

This firm owns another factory in the country about 50 miles from St. Etienne, which is run on the same electric system, with this difference, the electric power is conveyed to the factory, a distance of eight miles, by means of overhead cables. The generators are worked by water.

So far Messrs. Forest & Company seem to be abundantly satisfied with their experiment. They claim that the advantages of the improvement are manifest, that the movement produced by electricity is more uniform and gentle than that obtained by steam, and that, while the cost of construction is not greater, there is more economy in the working and maintenance of electric machinery than under any other system.

In the neighborhood of Grenoble, in the department of the Isère, the application of electricity has had a marked effect upon its various industries. Electric bleaching of paper pulp is extensively resorted to in its paper mills. Near Grenoble, at a place called Lancey, there is a paper factory worked entirely by electricity. The current, feeding a motor of 200 horse-power, is trasmitted from a dynamo located five miles up the river. The largest aluminium manufactory in France, producing 200 kilograms a day, is also located near Grenoble. The Société Electrometallurgique Française have in course of construction at La Praz, in the adjoining department of the Savoie, a factory which will produce 1,000 kilograms a day, and it is believed that its capacity will be increased to 10,000 kilograms. A copper refining manufactory, that of M. Grammont, has been in operation for some years in the department of Isère; these works turn out 1,500 kilograms of wire daily.

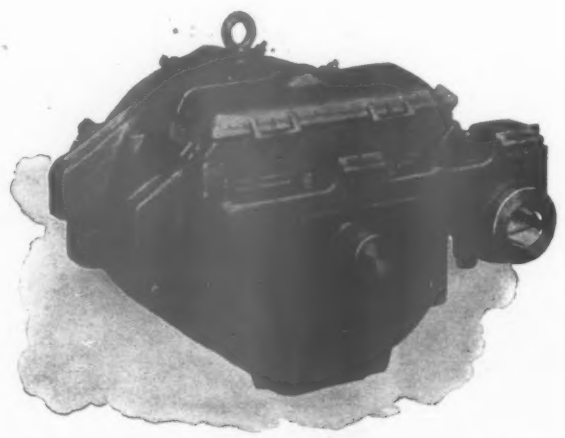


FIG. 2.—WESTINGHOUSE SINGLE REDUCTION RAILWAY MOTOR.

Another Incandescent Lamp Company.

The Livgro Incandescent Lamp Company was incorporated last week under the laws of New Jersey with a capital of $1,000,000. A factory has been secured at Harrison, N. J., which will be equipped with the most modern lamp making machinery. The company will make a lamp invented by Dr. Wm. Forest and which has been pronounced to be non-infringing. It is a stopper lamp with a metallic alloy seal, iron leading-in wires, and will be made with a high vacuum and in the best possible manner. The lamp has already undergone satisfactory tests and will be placed on the market inside of two months at ruling prices.

OF INTEREST TO LAMP MANUFACTURERS.

THE BATE REFRIGERATOR CASE.

The well-known Bate refrigerator case has been certified up to the United States Supreme Court by the United States Circuit Court of Appeals before whom it was argued last March. Unless a motion to advance the case is granted it cannot be reached in regular order in less than two years. It is unlikely that an exception will be made in favor of the Bate case, as there are many other cases equally as important already on the Supreme Court docket. If the case takes its regular order, as seems probable, the Edison lamp patent, on which it has a direct bearing, will legally expire in November next, thus permitting all the lamp factories now under legal restrictions to resume business. It is said that the owners of the patent can then take no further action until a decision of the United States Supreme Court has been rendered.

The Edison transmitter patent, owned by the American Bell Telephone Company, and many other important electrical patents will be affected by the final decision in the Bate case.

The issue involved in the Bate refrigerator case is as to whether the date of application for a United States patent or the date of issue shall prevail in applying the statute limiting the life of a domestic patent by that of a foreign patent. The law now is that a United States patent expires with any foreign patent issued before the date of issue of the United States patent.

American Street Railway Association.

The following is a list of the subjects and special committees appointed to report thereon, at the thirteenth annual meeting of the American Street Railway Association, to be held in the city of Atlanta, Ga., October 17 to 19, 1894.

"Can the T Rail be Satisfactorily Used in Paved Streets?" Joel Hurt, president Atlanta Consolidated Street Railway Company, Atlanta, Ga.; S. Hendrie, manager Wyandotte and Detroit River Railway Company, Detroit, Mich; H. J. Crowley, engineer Atlanta Consolidated Street Railway, Atlanta, Ga.

"City and Suburban Electric Railways." Elwin C. Foster, superintendent Lynn and Boston Railroad, Boston, Mass.

"Mail, Express and Freight Service on the Street Railway Cars." Richard McCulloch, electrical engineer Citizens' Railway, St. Louis, Mo.

"The Best Method of Treating Accidents and Complaints." John B. Parsons, general manager West Chicago Street Railroad Company, Chicago, Ill.

"Street Car Wheels and Axles." D. S. Cook, electrical engineer Trenton Passenger Railway Company, Trenton, N. J.

"Transfer and Commutation." Rodney Curtis, president Denver Tramway Company, Denver, Colo.

"The T Rail Construction of the Terre Haute Street Railway Company." M. F. Burke, superintendent Terre Haute Street Railway Company, Terre Haute, Ind.

"A Standard Form for Accounts for Street Railways." H. I. Bettis, consulting engineer Atlanta Consolidated Street Railway Company, Atlanta, Ga.

A MODERN MOTOR.

THE NO. 12 IMPROVED RAILWAY MOTOR OF THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY DESCRIBED AT LENGTH.

In a most artistic and beautifully prepared catalogue, from the press of Bartlett & Company, New York, the Westinghouse Electric and Manufacturing Company, of Pittsburgh, Pa., describe their latest and most improved type of railway motor, which is illustrated herewith. This company's No. 3 single reduction railway motor has been on the market for three years and has proved an eminent success; but in response to a demand for railway motors that are lighter, and especially that have less weight upon the car axles, types No. 10 and No. 12 have been produced. These new motors meet such requirements and are in all respects equal to the No. 3 type. They have been in practical operation for nearly a year and have been adopted by several of the leading street railway companies of the country.

The new motor, as seen in the illustrations, appears to resemble the No. 3 single reduction motor without the iron frame which serves as its support. The absence of this frame reduces the weight of the new motor without diminishing its rigidity. As a circular form of field may be mathematically proven to afford the greatest strength for any given weight of material, as a four pole field must evidently give greater output than one of only two poles, and as the toothed armature, with a two circuit winding and lathe wound coils, has been practically demonstrated to be unsurpassed, all these features of the No. 3 type of motor are retained in the newly designed machine.

The new motor is of the single reduction type; and the No. 12 is manufactured in three standard sizes, as follows: 20, 25 and 30 horse-power. The No. 10 is designed for heavier work, as follows: 40 and 50 horse-power.

In addition to the above, the company manufactures motors of similar style but of greater capacities to meet the special requirements of locomotive, elevated railway, mining and other service.

The armature is of the drum type and wound with machine made coils. Each of these coils consists of heavy insulated wire wound in rectangular form. The two longer sides of the coil are enclosed in cells of special insulating material, the whole being then wrapped with insulating tape of a superior quality. The coils are connected to the commutator segments so that the armature winding has only two circuits, which, as is well known, obviates the possibility of the armature becoming electrically unbalanced, and requires the use of but two brushes. The commutator segments are of the highest grade drop-forged copper of uniform hardness, and the mica insulation is of the best quality. The armature is short and compact and special means have been employed in its construction to prevent grease from the bearings coming in contact with the coils. These armatures are constructed in the same way as those of the No. 3 motor, which have been found to give such excellent service under the most exacting conditions.

The field consists of four pole pieces projecting rapidly inward from a

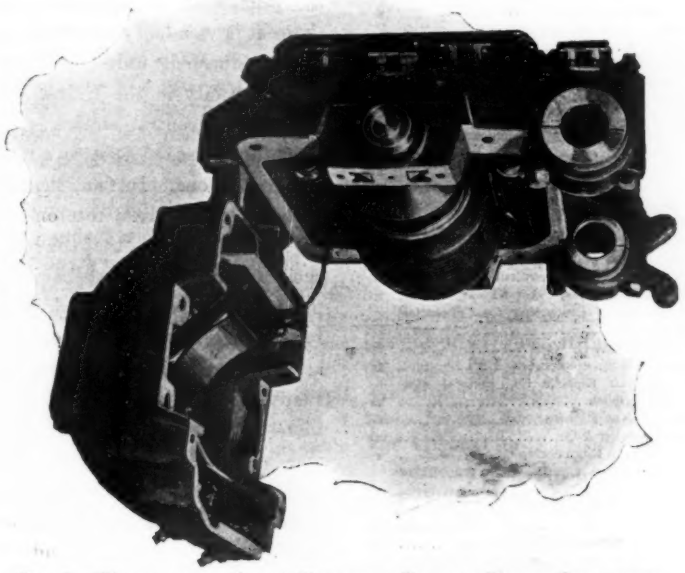


FIG. 3.—WESTINGHOUSE SINGLE REDUCTION RAILWAY MOTOR, OPEN, WITH ARMATURE IN UPPER FIELD.

circular yoke or ring which parts in a horizontal plane through the shaft. In order to secure rigidity of construction, the two lower pole pieces, half of the circular yoke and end plates are made in a single, solid casting, which secures strength and at the same time completely protects the lower half of the motor.

The rectangular frame, which was a distinct feature of the No. 3, has been incorporated into the upper half

FIG. 4.—WESTINGHOUSE SINGLE REDUCTION RAILWAY MOTOR, OPEN, WITH ARMATURE IN LOWER FIELD.

of the field of the No. 10 and No. 12, so as to do double service, forming a part of the magnetic circuit and a part of the frame, and thus giving sufficient strength to the motor to hold the armature shaft always in perfect alignment with the car axle. On the side which is farthest from the axle of the car, the two halves of the yoke are hinged together, so that the interior parts of the motor are made easily accessible without the necessity of dismounting.

The lower field casting has three openings, one directly below the commutator and the others at opposite ends of the casting. These openings are closed by water-tight covers, which may be removed to give access for the purpose of repair or removal of dust or dirt.

The field coils are wound and insulated in the same manner as in the No. 3 motor, although the capacity of the winding has been somewhat increased and the insulation is made, if possible, even more thorough.

The two brush-holders, 90 degrees apart on the top of the commutator, are held in position by a frame which is so designed as to constitute a part of the end of the upper field, and, together with a lid, completely encloses the commutator end of the motor, and entirely protects the inner parts. The lid is hinged and normally kept closed by a stiff spring, thus protecting the motor from water, snow and dirt, but allowing easy examination of the brushes and commutator.

The method of suspension relieves the axle of practically all the direct weight of the motor and avoids what has been termed "hammering" of the rail joints. By reason of the increased strength of the upper field yoke, it is possible to suspend the motor directly in the line of its center of gravity, by means of suspension bars which run parallel to the sides of the truck, and have their ends supported upon spiral springs. The motor is thus freed from jars and yet accurately maintains the meshing of the gears while yielding to the motion of the truck.

By reason of improvements which have been introduced and of a more efficient utilization of the iron in the fields and armature and of the copper in the winding, it has been possible to effect a material reduction in the weight of the new motor. This has been done only so far as consistent with a margin of mechanical strength adequate to meet the severe conditions of electric traction.

There is, perhaps, no feature of more practical value in a railway motor than the provision which is made for the rapid yet through inspection of the fields and armature. Reference to the illustrations shows the advantages of this motor in this respect. The hinged lid, already referred to, permits ready handling of the brushes and inspection of the commutator. The openings in the lower field afford access to the lower part of the motor. When it is desired to gain access to the whole interior of the motor, the car is run over a pit and the lower half of the field opened down, either with or without the armature, as may be desired. The armature bushings are carried in pillow blocks which, when the motor is closed, are secured to both the upper and lower field. By removing the bolts holding the pillow blocks to the upper half of the field, the lower half may be opened down with the armature, which can then be rolled out upon a board, thus avoiding the necessity of lowering the armature into the pit and again raising it. By removing the bolts between the pillow blocks and the lower half of the field, the armature is kept in the upper half of the field, permitting removal of the field coils, etc., in the lower half.

The lower half of the field is readily opened down by the use of a rope passed around the axle, which is thus made to take the part of a pulley block.

By the above construction and arrangement of parts, all repairs can be easily made from the pit, and consequently the grease and dirt accompanying repair work is not introduced within the car, a feature which will be at once appreciated.

The No. 14 controller stand is a platform controller having two removable handles, one for controlling the speed and the other the direction of travel of the car. The handles are provided with locking devices which prevent their removal except when in the position for no current. The electrical combinations of the motors made by the new controller are improved over those of the earlier type in that the motors divide the work equally, and the car starts more easily and attains its maximum speed more smoothly.

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CONTENTS.

	PAGE
Views, News and Interviews	209
Electric Capstans	209
Textile Manufacturing by Electric Power	210
Personal	211
A Shrine Badge for W. J. Clark	211
American Institute of Electrical Engineers	211
Electricity as Applied to St. Etienne, France, Industries	212
Another Incandescent Lamp Company	212
Of Interest to Lamp Manufacturers	212
American Street Railway Association	212
A Modern Motor	213
Electrical Development	214
Correspondence:	
Our Boston Letter	215
Our Chicago Letter	215
Chicago's Electrical Department	215
Obituary	215
Wall Street News and Electrical Stock Market	215
A Decision on Interior Wiring	216
The Rabbidge Telephone	216
Telephone News and Comment	217
The Torch Fish	217
Literary	217
The Detroit, Mich., Electric Lighting Muddle	218
New Alternating Current Ammeter	218
The White-Crosby Company	218
Electric Railway Notes	219
The Paragon Speed Indicator	219
The Nassau Electric Railroad Company	219
By Trolley from Newark to Jersey City	219
Questions and Answers	219
Alternating Current Resistance	220
Lien Against the Card Motor Company	220
The Electric Railway	220
Electric Lightships in Russia	220
General Electric Company's New Offices at Chicago	221
Intramural Cars for Brooklyn	221
Kindred Interests	222
Electrical Patents	xii
Advance Information	xii

INDEX OF ADVERTISERS.

COVER PAGES.

	PAGE
Abendroth & Root Mfg. Co	xviii
American Electrical Works, insulated wire	xviii
Ansonia Brass & Copper Co., wire	xviii
Armington & Sims, engines	xviii
Beacon Vacuum Pump and Electrical Co	i
Bunnell & Co., J. H	i
Campbell Electrical Supply Co., insulating tape	i
Day's Kerite, insulated wire	i
Eastern Electric Cable Co., insulated wire	xviii
Eddy Electric Mfg. Co., motors	i
Globe Iron Roofing and Corrugating Co	i
Goubert Manufacturing Co., Stratton separators	xviii
Hampson & Co., E. P., engines	xviii
Manhattan Electrical Supply Co	i
McKenney & Waterbury	i
National India Rubber Co	i
New England Engineering Co	ii
Okonite Co., insulated wire	I, xviii
Rhode Island Tool Co., drop forgings and tools	xviii
Royal Arc Electric Co	i
Stirling Co., boilers	xviii
Underwood Co	i
Weston Engine Co., engines	i

INSIDE PAGES.

American Bell Telephone Co	xiv
American Carbon Co., carbons	x
Baker & Co., platinum	xii
Ball & Wood Co., engines	ix
Berlin Iron Bridge Co., iron roofs and buildings	xvi
Bishop Gutta Percha Co., insulated wire	vi
Brush Electric Co	vi
Bryant Electric Co	vii
Buckeye Electric Co., incandescent lamps	x
Buckeye Engine Co., engines	iv
Case Engine Co., The J. T., steam engines	iii
Central Electric Co	iv
Clark Electric Co., arc lighting	xiv
Clonbrock Steam Boiler Works	vii
Correspondence School of Electricity	222
Correspondence School of Mechanics	222
Day-Moberg Electric Co	xv
Diehl & Co	iv
Dixon, Jos., Crucible Co., belt dressing	vii
Edson, Jarvis B., gauges	iii
Electric Construction and Supply Co	iv
Electrical and Mechanical Engineering and Trading Co	xii
Electric Storage Battery Co., accumulators	xv
Empire China Works, porcelain specialties	xiv
Equitable Life Assurance Society	222
Falls Rivet & Machine Co., friction clutches	xv
Faraday Carbon Co., carbons	vii
Fidelity Carbon Manufacturing Co., carbons	xiv
Fort Wayne Electric Co., elec. machinery	viii
Garvin Machine Co	iii
General Electric Co	v
General Electric Launch Co., electric launches	222
General Incandescent Arc Light Co., arc lamps	xiii
Gooch, Chas. J., patents	xii
Greeley & Co., The E. S	xvi
Harrisburg Foundry & Machine Works, engines	vi
Harrison International Telephone Co	xiv
Hathaway Office Building	xii
Hill Electric Co., W. S	iv
Hlasko, V., vacuum pump	222
Hornberger Electric Mfg. Co	iii
Hulbert Fence and Wire Co	xiv
Johns Mfg. Co., H. W., vulcabeston	iv
Leffel & Co., James, water wheels	xvi
Lehigh Valley Creosoting Co., creosoted lumber	222
Leonard & Co., H. Ward	222
Marshall, Wm., condensers	xiv
Metropolitan Electric Co., general electrical supplies	xi
Moore, Alfred F., wire	vii
Morris, Tasker & Co	xv
New England Engineering Co	x
New York Belting and Packing Co., rubber belts	xiv
New York Insulated Wire Co., wires and cables	xv
New York & New England R. R	xii
New York & Ohio Co., incandescent lamps	x
Ostrander & Co., W. R., supplies	vi
Pettingell-Andrews Co	xvi
Phoenix Glass Co., globes	vii
Photo-Engraving Co., engravings	xiv
Pope, Read & Rogers	222
Proposals for Lighting	222
Proposals for Lighting City of Jackson, Tenn	xii
Proposals for Miscellaneous Articles	222
Queen & Co., electric dynamometer	xii
Ridlon & Co., Frank, general machinery	vi
Ritchie, E. S. & Sons	xii
Robinson & Orr, steel rails	vi
Rosenthal, Dr. R. S., Correspondence School	xii
Royce & Marean, electrical supplies	vi
Schieren, Chas. A. & Co	222
Siemens & Halske Electric Co	iii
Splitdorf, C. F	vi
Standard Paint Co	x
Stanley Electric Mfg. Co., transformers	xiii
Western Electric Co., supplies	xiv
Western Telephone Construction Co	xiv
Westinghouse, Church, Kerr & Co	222
Westinghouse Electric & Manufacturing Co	vii
Weston Electrical Instrument Co., measuring instruments	x
White, Crosby & Co	222
White Dental Mfg. Co., acid gravity battery	vi
Wilson, Fremont, electrician	222
Wyckoff Pipe Co., inc	iii

The whirr of the cooling fan motor will soon be abroad in the land.

"The weekly advent of the ELECTRICAL REVIEW is a pleasure to us." Thus write Fairchild & Company, of New York.

Probably the greatest of the many undeveloped fields for electrical advance is the long distance transmission of power.

The trend of expert opinion is that the electrical purification of sewage is a complete success, chemically and bacteriologically.

The amount of electric railway construction now in progress justifies our prediction that this would be a great electrical year.

Gas motors for street railways seem to be making friends in Germany. The demands of American rapid transit seem to be fully met by the trolley road, which emits no soot, smoke or ill odors.

ELECTRICAL DEVELOPMENT.

Electric lighting has become such a recognized necessity and the apparatus employed is so commercially successful and economical that the public has ceased to wonder at its growth. The development of this application of electricity is chiefly in the line of increased efficiency and in the refinement of apparatus, while there is a tendency towards large direct-connected units. There is scarcely a city in the United States in which a central station can be profitably operated that is not provided with one. In fact, the manufacturers of electrical machinery are beginning to realize that the bulk of their future sales must be isolated plants, municipal plants and renewals for existing central stations. There are a few large cities, however, where there is room for competing companies—a competition that will in the end help the present companies as well as the public by working up an immense demand for the electric light.

The electric railway business, considerably younger than the lighting industry, is truly marvelous in its development and growth. In many of the principal cities of the country not a single horse car is in use to-day, while the number of interurban lines is surprisingly large. Projects for long roads, as between Philadelphia and New York, are numerous and some of them seem possible. Capital is easily attracted to such schemes, when the prospect of a return on the investment is fair and the engineering talent of the right character. Probably no State in the Union is so thoroughly covered with a net-work of trolley roads as Massachusetts, and it is probably possible, or soon will be, to travel from one end of the State to the other on trolley cars.

Electric power development is showing itself most prominently in the utilization of water powers for long-distance transmission and in the equipping of all kinds of machinery with electric motors. There are many manufactories now using electric power entirely to the exclusion of belting and line shafting, the saving in power exceeding the increased first cost of the motor installation.

The patent situation is such that development in telephony is taking place principally in private lines and interior telephone systems, although a number of exchanges are being installed by new companies in this field. The American Bell Telephone Company is progressing rapidly in the character of its new exchanges, the increased efficiency of its service and the placing of its wires underground.

Telegraphy is such an exact art that its chief characteristic is one of simple growth, although a number of labor and time saving devices have recently been developed. Several new ocean cable projects are in sight, the most recent being the inauguration of the work on a third Atlantic cable for the Commercial Cable Company.

The storage battery, although it has suffered slightly in the past, has many loyal and persevering adherents, and will, we predict, be emphatically heard from before many days.

The new electrical system—be it conduit electric railway, telephone, electric lighting, or what not—that makes its first bow to the public through the medium of the untechnical daily press is always looked upon with suspicion by electrical engineers. In the majority of instances this suspicion is well founded, for the system that will not bear, and that does not court, the scrutiny of practical electrical men is doomed to an early death.

After a careful study of the situation we have reached the conclusion that there will be fewer electrical and allied journals in this country six months hence. Long-felt and gaping wants don't seem to desire being filled, and it is hard satisfying the printer and paper man with neither paying subscribers nor ditto advertisers.

Why can't American carbon manufacturers compete with their French and German brethren in making a cored carbon? There is a large and growing market for an American cored carbon that is satisfactory and which must now be supplied with the imported article.

It is in the Summer time that electric train lighting gains the greatest number of advocates. The heat emitted from oil and gas lamps is a serious defect in the otherwise perfect arrangements for comfort enjoyed by the American traveler.

Brooklyn, N. Y., will soon have a greater number of incandescent arc lights for street illumination than any other city. The Edison company expects to have 3,000 in operation before long.

Enclosed please find cheque of $6, amount of my subscription to your valuable journal to January 1, 1895. Wishing you increased success the coming year, I am, yours truly.

CHARLES PLUMB.

Buffalo, April 16.

CORRESPONDENCE.

OUR BOSTON LETTER.

The Natick Electric Street Railway Company have determined to extend their line through Ashland to Hopkinton, and the construction will be commenced at once. This work will cost in the neighborhood of $40,000.

The Thomson Welding Company, of Lynn, Mass., have recently shipped one of their special cars equipped with welding machinery to Brooklyn, N. Y., on an order from the Johnson Company, of Johnstown, Pa., who will use it in welding the rails of the Nassau Electric Railroad Company in Brooklyn.

The Beacon Vacuum Pump and Electrical Company, of this city, report a rushing business in their new Beacon lamp, the demand for which has been very satisfactory for some time past. Among the larger contracts closed recently is one for the entire installation of the new Mutual Reserve building, one of the finest structures in New York. This contract will comprise something between 2,500 and 3,000 lamps.

The Chicopee Street Railway Company has just been organized with a capital of $100,000 to build an electric road from Holyoke to Springfield, passing through Willimansett and Chicopee Falls. The road will be about 10 miles long. The directors are Charles C. Abbey, Ex-Senator Gibson and Jas. H. Loomis, of Chicopee; William Kickham, of Worcester; J. E. Delaney, of Holyoke, and Selig Manilla, of Springfield.

The enterprising firm of G. M. Angier & Company, of 116 Bedford street, Boston, have acquired the exclusive New England agency for what they consider "three good things." These comprise the well-known Kester arc lamp, for direct or alternating currents, the Climax iron-clad rheostats and stage dimmers and the Sechrist automatic switch. The "three good things" are meeting with a very general demand among central stations and construction companies.

Mr. R. A. Stuart, general manager of the Campbell Electrical Supply Company, of this city, has just returned from a flying trip through Pennsylvania, during which he managed as usual, to get through an immense amount of work. He reports general business in that section as greatly improved, and closed a number of good contracts for some of his leading specialties, besides breaking ground for others of special importance. The Spring season has brought with it a strong demand for Century insulating paint, orders for which are coming in by wire faster than they can be filled. The Campbell company has control to-day of some of the best specialties in the electrical field, and is constantly acquiring more. Mr. Stuart is one of the most active and persistent hustlers in Boston electrical circles, and has some further good things up his sleeve which will be heard from shortly. H. G. T.

Boston, April 28.

OUR CHICAGO LETTER.

A New Catalogue.—The Metropolitan Electric Company, 186 Fifth avenue, Chicago, has favored the western office of the ELECTRICAL REVIEW with a handsomely bound copy of its new catalogue. There are 452 pages, 6x9 inches in size, filled with practical information relative to the latest goods on the market. A more extended notice of this work will appear in these columns later, and this brief note is merely inserted in order that none of our friends may be overlooked in the distribution. F. DE L.

Chicago, April 28.

CHICAGO'S ELECTRICAL DEPARTMENT.

BY FRED. DE LAND.

The annual report of Prof. John P. Barrett, Superintendent of the City Fire Alarm Department and City Electrician, of Chicago, has been received from the printer's, and a synopsis of the same is presented herewith.

Fire alarm system: There are 1,103 street fire alarm boxes and 773 public and 372 private police alarm boxes. The total number of fire alarms for the year was 6,700, an increase of 1,951 over the preceding year. Two hundred and thirty-one and one-half miles of overhead wires were added, and 236 miles renewed, making total of 2,070½ miles of aerial wire in the city telegraph service. To the underground service has been added 6,393 feet of iron pipe, seven manholes, 3,375 feet of two conductor, 950 feet being Okonite and the balance Kerite cable, 426 feet of Cobb Vulcanite seven conductor cable and 709 feet of 30 conductor Patterson cable.

Police telegraph system: Sixty-nine public and 13 private police telephone boxes have been added. Five million two hundred and sixty-eight thousand eight hundred and forty reports were received from policemen in districts. Overhead wires and poles belonging to the city were removed from 11 different streets, covering a distance of nearly 50 blocks.

City electric lighting system: Additions include 10,473 feet of pipe, from one to three inches in diameter; 2,000 feet of four conductor, 2,965 feet of six conductor and 8,404 feet of single conductor cable and 10 lamps. During the year 1,110 2,000 candle-power arc lamps have been operated from four stations, at a cost of $107,-277.93, an average cost of $96.64 per lamp per year. The cost, in detail, for material and labor, the lamp hours and the cost per lamp hour, etc., is shown in appended tables. During the year 2,586 feet of Okonite cable was used in connecting lamps at top of lamp post to main conductors. Of the lead-covered cable used during the year, 2,580 feet was Cobb, 7,120 Patterson, 6,645 Safety, 43,233 Roebling and 1,375 feet Okonite. The total length of conductors used in feet is 84,364.

The repair shops of the electric light department rewound three and repaired nine armatures; reconstructed 18 and repaired 65 commutators and repaired 895 lamps. Other light repairs are also tabulated.

The city electric system includes four power stations; thirteen 125 horse-power high speed engines and one 300 horse-power Corliss engine; 21 boilers; 1,269 arc lamps; 1,112 lamp posts; eleven 60 light, eight 50 light, fourteen 35 light and ten 30 light arc dynamos; 185 miles of electric light cable; 12,109 feet of underground conduit; 584,496 feet of iron pipe laid underground; 355 manholes and 114 handholes. From the above should be deducted one entire plant sold by Professor Barrett to the Metropolitan Elevated Railway Company, and to be shortly turned over, for which they paid the full original cost, although all the apparatus has been in use for several years.

On January 1 there were 237 lamps in service in the north division, 563 in the south division (212 of which were rented), 522 in the west division, making a total of 1,110 lamps operated from the city plants. These lamps were operated a total of 4,383,102 lamp hours at a cost per lamp hour of 2.44 cents. In estimating the total cost per lamp per year, of the $96.65, $51.83 is charged to labor and $44.82 for material.

It is interesting to note that of underground cables and conductors maintained in the city by the various electric companies, there are 706 miles of cables of all sizes, and 21,670 miles of conductors. The greatest length of time any of these have been in service is eight years for the Western Union Telegraph Company, six years for the Chicago Edison Company and 17 years for the city wires.

Electric Light Inspection: On this subject Professor Barrett writes in his annual report: "During the year we have been enabled with our increased force to pretty thoroughly cover the work of inspection. All concealed work is examined before being covered. Each large installation has an inspector detailed to follow it. He reports on all material used and construction employed. His reports are on file at the office, and are sought by the architect, owner, engineers and others as giving the most exhaustive information to be obtained. We are represented on acceptance tests, and are frequently withholding certificates until the results of the test demonstrate the proper condition of the plant. By co-operation with the architect we obtain specifications of all large electric light installations; by co-operation with the insurance interests we have received material assistance in actual service, and much valuable technical information. During the year we have re-inspected all isolated plants installed prior to 1892. During the coming year we propose to re-inspect all plants installed in 1892 and 1893, and to thereafter re-inspect all isolated plants annually."

A summary of the Inspector's reports shows that 25,766 arc lamps and 442,495 incandescent lamps and 1,773 motors of 5,377 horse-power have been installed in the city. There are now 37 central stations in Chicago operating 6,139 arc and 184,943 incandescent lamps; 506 isolated plants, operating 8,181 arc and 179,736 incandescent lamps; making with the four regular city stations and the two old stations, a total of 549 power stations, operating 15,432 arc lights and 365,829 incandescent lamps.

OBITUARY.

Jesse H. Lippincott, organizer of the North American Phonograph Company, died at Newton Centre, Mass., on April 18. He became paralyzed in October, 1890, and never recovered.

Wall Street and the Electrical Stock Market.

The Wall Street market during the period under review has been of the bear order. It was narrow, professional and prices gradually sagged with only spasmodic and temporary rallies.

General Electric suffered considerable pressure, the major portion of which was from short stock. The lowest price touched was 37¾, and the highest price was 39¼. The rally from the lowest to the highest was on the belief that some action would be taken looking toward a correction of the impairment of the capital stock. I asked President Coffin what action, if any, had been taken in this matter, and he said that as yet no move had been made and that it was probable that some months would elapse before the question would be settled. After a proposition had been submitted to the shareholders the impairment could be adjusted within a short time. He said that it was certain that no dividends would be paid on the preferred stock until the impairment had been corrected. The preferred stock advanced to 73, under the belief early in the week that the dividend might possible be resumed. Later when it become known that such would not be the case for some time, the stock dropped to 70.

Edison Electric Illuminating sold in odd lots on Monday at 100. The first 5 per cent bonds sold at 106¾ to 107⅜.

Bell Telephone on the Boston Exchange was strong, selling up from 188½ to 191½. There is every indication of a big fight between the Western Union and Bell Telephone when the present contract between the two companies expires. This, I understand, provides that Western Union will not do a telephone business, and Bell Telephone will not do a telegraph business. Western Union charges Bell Telephone with using its wires for telegraph business, notably Wall street service, and its looks upon the move that the telephone company is now making to extend its telephone lines as a preparation for further telegraph business.

I am told that the Harrison Telephone Company is troubling the Bell company by its operations. It has opened an office at 44 Wall street and is making preparations to enter New York city with its system. It has made a deal with the American District Telegraph Company for the use of the latter's wires. It is said that a test on these wires has been made and has proved highly satisfactory. The District company has 38,000 boxes in this city. The company is a strong one and claims that its patents have been tested in the courts, and that it has plenty of capital back of it.

Westinghouse securities were very strong, the preferred selling at 52, and the assenting at 38. It is said that the company is increasing its assets and decreasing its liabilities every month, and makes it almost certain that it will either pay dividends on stock within a year or accumulate a considerable cash surplus. The company now owes about $700,000 or a reduction of two-thirds in its debt, and has outstanding in its favor $2,500,000 of bills and accounts receivable.

Of the electrical stocks of less activity, Fort Wayne Electric was bid 2¼ and held at 2½. Erie Telephone was steady at 46½; New England Telephone at 54 to 55; Commercial Cable was bid 130; Interior Conduit made an actual sale at 49¼, which is a sharp advance over previous quotations. BAIN.

New York, April 28, 1894.

A DECISION ON INTERIOR WIRING.

INTERIOR CONDUIT AND INSULATION COMPANY VS. EUREKA ELECTRIC COMPANY.

Judge Coxe, of the United States Circuit Court, Southern District of New York, has handed down a decision in the case of the Interior Conduit and Insulation Company *vs.* Eureka Electric Company, dismissing a bill of complaint on a patent for interior wiring granted to Johnson and Greenfield. R. N. Dyer and D. H. Driscoll for complainant; Francis Forbes and C. E. Mitchell for defendant. The New York Insulated Wire Company defended the suit. The decision is given in full herewith:

This is an infringement action based upon Letters Patent No. 401,498, granted to Johnson and Greenfield, April 16, 1889, for improvements in wiring structures for electric lighting.

The object of the patentees was to provide buildings with wires for electric lighting which can be readily removed and replaced by other wires. A second object was to furnish protection from fire. There are four sheets of drawings and a description which enters minutely into details, but the improvement in controversy may be stated briefly to consist in placing a pair of wires, each wire forming one side of an electric lighting circuit, into a pipe made of insulating material, a safety catch being interpolated in said circuit.

The first and third claims are the only ones involved. They are as follows:

"1. In house wiring for electric light, the combination of a pipe of insulating material, a pair of wires insulated from each other and placed in close proximity to each other within said pipe, and each forming one side of an electric lighting circuit, and a safety catch interpolated in said circuit, substantially as set forth.

"3. In house-wiring for electric light, the combination of a pipe of insulating material, a pair of insulated wires twisted together within said pipe, each wire forming one side of an electric lighting circuit, and a safety catch interpolated in said circuit, substantially as set forth."

The defenses are lack of novelty and invention, non-infringement, defective title and the absence of an oath from the amended specification.

The combination of the claims is limited to the following elements in house wiring for electric lights:

First. A pipe of insulating material.

Second. A pair of wires insulated from each other and placed in close proximity to each other within said pipe, and each forming one side of an electric lighting circuit.

Third. A safety catch interpolated within said circuit.

The third is like the first, only it is still further limited to a pair of wires twisted together. In the specification as originally filed, the patentees claimed the invention without reference to the material of which the pipes were constructed. Indeed, metal pipes were used by them prior to the application.

They also assert in the specification as filed that instead of one tube with two wires, two tubes containing one wire each may be used without departing from the spirit of invention.

The application was rejected upon several references, the examiner holding that the applicants had merely adopted the well-known underground system for use in buildings, and that it was not new to run electric wires through pipes under the plaster of buildings. The applicants thereafter amended, the principal change being the limitation of the claims to pipes made of insulating material. The application was again rejected on the Martin patent No. 286,940, which shows paper tubes for conveying electric wires, the examiner observing that "the mere fact that the pipes are of insulating material is not patentable." He also pointed out that safety catches were old.

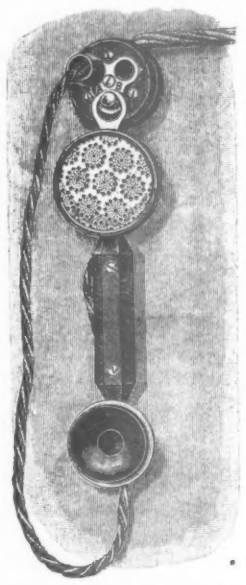
The specification was again amended and thereafter the patent issued.

The complainant's brief concedes "that each of the elements of the combination claimed in claims 1 and 3 of the patent in suit was individually old. The insulating tube was old, the twin conductor was old and the safety catches were old." Again, the brief says: "Thus, the patents in evidence show that the character of paper tube set forth in the complainant's patent was not in itself new, but could be produced by anyone skilled in the art."

The question then is, did it involve invention to place the old twin wires in the old insulating tube and interpolate a safety catch in the circuit?

If there were nothing more of the prior art shown than is contained in the foregoing admissions there might be difficulty in reaching a correct answer, but it further appears that the following devices and combinations were old.

First. Short lengths of insulating tubing were used in this art in the walls and partitions of buildings.



THE RABBIDGE TELEPHONE.

Second. Zinc and wooden tubing was used in the side walls of buildings with single wires.

Twin wires have been run through the tubes of chandeliers and through zinc tubes five or six feet long in the walls of buildings. Safety catches had been used in connection with a circuit formed by two wires drawn through the pipe of a chandelier.

Third. The complainant's brief sums up the distinguishing merits of the alleged invention as follows:

"Such, then, being the admitted facts, it is apparent that the invention of Johnson and Greenfield resides in the peculiar way of utilizing the general knowledge that electric wires in a close proximity tend to a short circuit, which general knowledge was availed of before by separating the conductors so as to avoid this short circuiting. Now the peculiar way in which Johnson and Greenfield availed themselves of this general knowledge is by combining the three known elements, which were never before combined, so as to bring about the short circuiting of the wires to quicken the action of the safety catch."

But it would seem that all this was clearly disclosed by Mr. Johnson himself in his patent No. 359,726, granted in March 1887. The specification says:

"I have discovered, however, that by bringing the conductors close together, and so arranging and constructing them that any imperfection of the insulation will immediately establish an arc between the conductors themselves of such low resistance as to amount to a practical short circuit, the safety catches will be invariably fused and the circuit broken before damage can occur.

"It will be seen that there can be no contact of the inner conductor with any external object except through the outer conductor. The breaking down of the insulation separating the conductors will with certainty produce an arc of such low resistance as to effect a short circuit between the conductors, instantly fusing the safety catch or safety catches protecting the particular conductors, and breaking the circuit, or the two conductors being in such close proximity, will be soldered together by the fusion of the lead covering, which evidently will form a short circuit between them."

Fourth. In 1876 Edward A. Hill obtained a patent, No. 176,784, in which occurs the following statement:

"I propose to provide a series of tubes or pipes broken at each turning, and at intervals along their lengths, by open spaces, to afford access to the bundle of several wires which are run through said tubes. These tubes or pipes are laid throughout the building, preferably supported by the lathing before the plastering is applied."

Fifth. In 1883 John F. Martin obtained a patent No. 275,399, the object of the invention being "To provide a non-combustible and fire-proof conductor for electric light and other wires to be conveyed through buildings." This is accomplished by providing tubes of paper with an insulated lining.

Sixth. In 1884 Henry Edmunds obtained a patent, No. 291,170, in which he describes the inconvenience of passing the conductors through long lengths of pipe and obviates this alleged difficulty by placing two insulated wires in a metallic case.

Seventh. The patent granted in 1884 to Jonathan H. Vail, No. 308,713, shows two insulated wires twisted precisely as shown in the patent at bar and inclosing pipes of lead with safety catches interpolated in the circuits. In short, if for the lead pipe, which is a poor conductor, were substituted a pipe of insulating material the Vail combination would be almost the exact counterpart of the combination of the claims.

Eighth. The record also shows that the systems approximating the system of the patent were well known in underground wiring.

Enough has been said to demonstrate the proposition that this patent rests upon an exceedingly vague and shadowy foundation. What did these patentees do?

Grant that they were the first to place the old twin wires into a tube made of insulating material it certainly did not require invention to do this. One of the patentees when asked whose idea it was to use this tubing said, "We both recognized intuitively the necessity for such material if we were to evolve a perfected conduit system for electric wiring." In other words, the idea of using the old insulating pipe would come spontaneously to any skilled electrician. But, as before shown, they were not the first to use a non-conducting tube in this way.

I have examined the patent with care to discover what new idea it has contributed to the art and am compelled to think that the art of electric lighting would have lost nothing tangible if the statements of the patent had never been made public. I cannot resist the conclusion that many of the marvelous attributes ascribed to the patent are after thoughts which find their origin largely in ardent and ingenious expert imagination. It may be doubted whether the patentees themselves were conscious, when they put the old wires in the old pipes, that they had made a discovery which cured all the defects of the past and was to lay a heavy tribute upon all electrical wiring in the future. What they did do seems most simple to the ordinary layman. Both were accomplished electricians. Mr. Greenfield had had large experience in wiring buildings. In 1883 he had wired the Mills building by drawing insulating wires through zinc tubes. Mr. Johnson had a cottage at Greenwich which he wished to have wired. He consulted Mr. Greenfield on the subject and the latter describes what occurred at the supreme moment when the invention had its birth. "Mr. Johnson asked me if I couldn't wire that cottage in a way so that the wires could be got at and repaired, if necessary, without tearing up any of the building, and I told him yes, I thought that I could put in a system of tubing which could be used for race-ways, if properly constructed, making a continuous channel," and he said, "Greenfield, go ahead and do it," which I did. Most assuredly he did it! What else could he do? He had done substantially the same thing before in the Mills building and he utilized his knowledge to suit the changed condition precisely as any other skilled electrician would have done after he was told what was wanted. The attempt to magnify this apparently simple exploit into an invention of surpassing excellence can be accomplished only by the substitution of theories based upon the imagination for facts based upon the evidence.

If the construction, broad enough to cover the defendant's structures, is placed upon the claims they must be held invalid. If limited to a complete system of pipes extending continuously through the building, "from supply to consumption," as shown in Fig. 1 of the patent, the claims may be upheld. But the defendant does not employ such a system, and, in no event, is the third claim infringed for the reason that the defendant does not use a pair of wires twisted together.

It follows that the bill must be dismissed.

NOTE.—I observe that the objection is taken that complainant's title is proved by certified copies of assignments. If the plaintiff proposes to appeal, the necessary proof should be supplied unless the point is waived by the defendant. The complainant could not, of course, anticipate that the rule which has obtained for so many years in this circuit would be changed, as it has been in a recent decision familiar to both counsel. (Railway Company *vs.* The Mayor). If the complainant desires it may have 20 days from the date of filing of this decision to prove the original assignments.

The Rabbidge Telephone.

The India Rubber, Gutta-Percha and Telegraph Works Company, Limited, have recently placed on the market the Rabbidge telephone shown in the accompanying illustration taken from London *Lightning*. This telephone is designed for speaking over short lines, such as would connect the different rooms in a large warehouse or block of buildings. The usual call bell is replaced by a small vibrating reed in the receiver, which, when the circuit is closed, gives a clear note pleasanter than the sound of a bell. A small tube containing mercury automatically changes the connections when the instrument is inverted; this stops the sound and acknowledges the call, which is made by removing a plug from one hole to another. The act of inverting the instrument also tends to prevent packing of the carbon granules in the transmitter. The whole is so small that it can be conveniently screwed to the side of the desk, so saving the trouble of moving to an instrument fixed to the wall.

TELEPHONE NEWS AND COMMENT.

The members of the Paris Stock Exchange who use the telephones for communicating with London, Brussels and the provinces, have been in the habit of settling their telephone accounts at the Bourse at three o'clock. One day recently they were surprised to be called upon to pay for their communications before they were allowed to enter the telephone box. They were also told that they would have to declare beforehand whether they required one or two conversations and to pay accordingly. The indignant members of the Stock Exchange held a meeting on the steps of the Bourse, and decided that they would not use the telephones until the vexatious regulations adopted by the authorities were withdrawn. From mid-day until two o'clock the long-distance telephones were at a standstill, when it was officially announced that the telephone authorities had withdrawn the orders that had given umbrage and peace was restored.

The Providence Telephone Company is extending its subways.

The Harrison International is to reduce its $80,000,000 capital—a business-like idea.

Bowling Green, Ky., is promised a telephone exchange 40 per cent cheaper than at present.

Parkersburg, Va., is to have cheaper telephone service for residences, beginning May 1.

Salem, O., business men will organize a telephone company there and charge $20 per 'phone each year. What system?

The annual meeting of the New England Telephone and Telegraph Company will be held at 18 Cortlandt street, New York, on May 7.

There was considerable damage done by the late storms to New England telephone companies. The West was quite a sufferer also.

The Citizens' Telephone Company, of Cumberland, Md., has been organized with L. D. Rohrer as president. Forty dollars per annum rental for offices and $20 for residences will be the charge.

A very cautious and conservative Pekin, Ill., paper ventures to remark: "A new telephone company is reported to be organizing in this city. We know nothing of the truth of the rumor, but merely give it publication."

The output of the American Bell Telephone Company for the month ending April 20, 1894, was as follows:

	1894.	1893.	Inc.	Dec.
Gross output	7,517	9,972	....	2,455
Returned	4,698	4,268	430	....
Net	2,819	5,704	....	2,885
Since Dec. 20:				
Gross output	22,925	32,108	....	9,183
Returned	23,069	17,927	5,142	....
Deficit	144 sur	14,181	14,325	....

Morris Olshin, arrested on a warrant issued by a Hoosick Falls magistrate, and charging grand larceny, appeared by telephone through counsel, was arraigned, and discharged from custody, all the proceedings being by telephone wire, at Troy, N. Y.

The officers of the Sunset Telephone and Telegraph Company, San Francisco, are: President and general manager, John I. Sabin; vice-president, M. Greenwood. Directors, J. C. Cebrian, Oliver Eldridge, F. W. Eaton, E. S. Pillsbury and John E. Hudson. Secretary and auditor, Percy T. Morgan; general superintendent, John Lawrence. This company is making a number of important improvements.

The circular letter sent to all of the subscribers of the Wisconsin Telephone Company, notifying them that a charge of two cents for each call in excess of 1,000 a year would be made, has been rescinded. Henry C. Payne, president of the company, accomplished this recently on sending out the following circular:

To the Patrons of the Milwaukee Telephone Exchange:

The circular letter issued by this company under date of the 31st. ult. is hereby withdrawn, and our business will continue to be conducted upon the same basis as has heretofore obtained. Yours, very truly,

WISCONSIN TELEPHONE COMPANY,
By H. C. PAYNE, *President.*
Milwaukee, April 12, 1894.

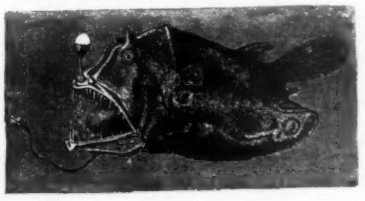
The reason for recalling the circular issued by General Manager McLeod was the great opposition it was met with by the subscribers. This company is arranging for a number of improvements. A quarterly dividend of one and one-half per cent has just been declared by the Wisconsin company.

A conference of the local managers of the Colorado Telephone Company throughout the State was held at the office of General Manager Field in Denver on the 29th. There were present P. W. Johnson, of Cripple Creek; J. A. Voorhees, of Colorado Springs; R. R. Rodda, of Central City; G. G. Seelye, of Pueblo; J. R. Whalen, of Leadville; J. S. Fisher, of Aspen; H. C. Legge, of Boulder. Chairman Field announced that with the lapse of the original Bell patent on the magneto transmitter, a number of concerns were preparing to put private outfits on the market. His company would furnish a handsome instrument at $7.50. It will have the call bell and two magneto telephones, one for use as a receiver, the other as a transmitter. It was also announced that by August two new lines would be constructed between Pueblo and Trinidad and Leadville and Aspen, thus joining all the present lines in the State in one great circuit.

The May number of *The Forum* continues the analysis of the present interesting and peculiar political situation with two articles on "A Year of Democratic Administration," one by ex-Governor Russell, of Massachusetts, from the Democratic point of view, and the other from the Republican point of view, by Senator Cullom, of Illinois.

The Torch Fish.

One of the most noteworthy and striking facts of animal life is its adaptation to the conditions of its environment. Study any animals or group of animals, and it will be seen that its leading physical characteristics are in exact adaptation to its habits and conditions. A very interesting illustration is afforded by the torch fish (*Linophryne Lucifer*), a cut of which, taken from *Schorer's Familienblatt*, Berlin, and published in the *Literary Digest*, is given herewith. The torch fish is a deep sea fish carrying on his nose an organ which he can illuminate with a phosphorescent light or extinguish at pleasure. *Linophryne Lucifer* does not use his lantern to guide him on his pathless course in the dark depths of ocean, or to enable him to look around him; but, when meal time comes, he lights up to attract smaller fishes, which, mistaking the lantern for a phosphorescent insect, dart straight for it, only to find their way into the capacious jaws of *Linophryne Lucifer*. The mode in which the lantern is lighted and extinguished is not yet clearly understood. The illustration appeared originally in Haacke's "Schöpfung der Thierwelt."



THE TORCH FISH.

We were skeptical regarding even the existence of this animal, but believing that there might be something of electrical interest in the matter, Mr. Nikola Tesla was consulted. Mr. Tesla's opinion was that if such a fish existed, and if it had the attributes credited to it, it was very strange that neither Lord Rayleigh nor Prof. S. P. Langley had made any mention of it in their researches. Mr. Tesla was also of the opinion that if the phosphorescence did exist, it was not of an electrical origin.

A letter was written to Prof. S. P. Langley, secretary of the Smithsonian Institution at Washington, D. C., which called forth the following courteous reply:

TO THE EDITOR OF ELECTRICAL REVIEW:

Your note in regard to the so-called "torch fish," in the absence of Professor Langley, comes to me for reply.

The subject of phosphorescence in deep sea fishes is one which is but little understood, although many conjectures have been made in regard to it. If you will consult Vol. XXII of the "Report of H. M. S. 'Challenger,'" which you will doubtless find in any of the large New York libraries, you will find a very exhaustive article by Doctor Van Lendenfeld upon this subject.

It is not positively known that the organ on the nasal filament of *Linophryne* is luminous, although it appears probable. The idea that the fish has the power of illuminating it at pleasure is, so far as I know, purely conjectural, the idea having been suggested by Doctor Gunther of the British Museum. I think no one has seriously supposed that the phosphorescence is due to an electrical source. Yours, very respectfully,

G. BROWN GOODE,
Acting Secretary.
Smithsonian Institution,
Washington, D. C., April 25.

LITERARY.

"Consular Reports," for April, 1894, has been received.

"Annual Report of the City Engineer of the City of Omaha," January 1, 1894, has been received.

Peck's Export Purchase Index, Vol. 1, No. 1, for April, 1894, is a handsomely printed publication devoted to the interests of United States manufacturers engaged in the export trade. It possesses several novel features and is published by William E. Peck & Company, 62 William street, New York.

A new portrait of Benjamin Franklin has been discovered recently in Paris, a terra cotta medallion modeled from life, which shows the genial side of Franklin's nature better than any existing portrait. Paul Leicester Ford has written a brief article to accompany a photograph of it in the May *Scribner*.

A great Grant number, in token of General Grant's birthday, April 27, describes in a word *McClure's Magazine* for May. General Horace Porter, a member of Grant's staff, his Assistant Secretary of War, and, during the first term of his Presidency, his private secretary, writes of his personal traits, particularly of his truth, courage, modesty, generosity and loyalty.

"Alternating Arc Lighting" is discussed by H. S. Putnam in the May number of *Cassier's Magazine*, and attention is drawn to the many advantages of the system for both municipal and commercial purposes. Simplicity, flexibility and uniformity in the style and size of machinery, according to the author, are essential to the convenient and economical operation of an electric station, and these, he argues, are best attained with the system under consideration.

"Electrical Measurements for Amateurs," by Edward Trevert. Cloth, 117 pages, 46 illustrations. Price, $1. Sent prepaid on receipt of price by the ELECTRICAL REVIEW Publishing Company, 13 Park Row, New York.

The contents of this work cover in a way understandable to the amateur the subjects of electrical units, the measure of resistance and current measurement. The book is intended as an introduction to the subject of electrical measurements, and no attempt has been made to enter upon any refinements.

"How to Make and Use the Telephone," by George H. Cary, A. M. Cloth, 117 pages, 26 illustrations. Price, $1. Sent prepaid on receipt of price by the ELECTRICAL REVIEW Publishing Company, 13 Park Row, New York.

The author, who has had many years of experience in practical telephone work, has provided the unprofessional user of telephones with a practical treatise on the subject, illustrated with working drawings from which serviceable apparatus suited to private lines or systems of moderate dimensions can be built. The book is up to date and coming at a time when everyone is more or less interested in the telephone question, it should meet with a ready sale.

THE DETROIT, MICH., ELECTRIC LIGHTING MUDDLE.

THE DYNAMO AND LAMP CONTRACTS.

There has been so much backing and filling regarding the letting of the contracts for the municipal lighting plant at Detroit, Mich., that the public has but a confused idea of the situation. The contracts for the dynamos and lamps are now the chief topic of interest and in order to understand the matter a little history of the situation is given.

By an act of the Michigan Legislature, a public lighting commission was created for the city of Detroit, the members of the commission being appointed by Mayor Pingree. The commission is a representative body of responsible business men of Detroit, being composed of the following gentlemen: Messrs. Jackson, president, Hudson, Fyffe, Lathrop and Buttzel. The commission selected Mr. Alex. Dow, who was formerly the chief engineer of the Chicago office of the Brush Electric Company, as city electrician. Mr. Dow is a competent and first-class engineer in every respect.

During the month of January last the commission stated that they were ready to receive bids for boilers, engines, dynamos, lamps, etc., in accordance with a most rigid set of specifications issued by the commission. These bids were opened on January 30, and it was found that the Western Electric Company were the lowest bidders on the 100 light arc dynamos required. The Brush Electric Company were second on dynamos and on arc lamps were the lowest bidders. The different companies bidding on lamps were required to send in sample lamps and a most thorough and exhaustive test of the lamps was made, the result being that several of the lamps were thrown out as not meeting the specifications. The Brush lamp made a most excellent showing under the severe tests, and was practically the only lamp that fully met the requirements of the severe specifications. The Brush company was recently awarded the contract for 1,500 arc lamps.

The dynamos offered up to that time had not been examined and tested, and the people of Detroit and electrical people all over the country were very skeptical as to the Western Electric Company's ability to supply a successful 100 light dynamo. It is not remarkable, therefore, that a good deal of comment was made by parties interested, but not bidders, that the commission had subjected a dynamo that had not been tried and proven, especially as the Brush machines, the powers of which had been demonstrated, were offered at a figure only slightly in excess of the Western Electric Company's.

The general charter of the city of Detroit makes it necessary that all contracts be approved by the Common Council. There was in this case some doubt in the minds of the commissioners as to whether their contracts required the approval of the City Council, for the reason that the powers of the commission were so worded that in case the Common Council of the city of Detroit voted that it was advisable to establish a municipal plant, it became the duty of the commission to purchase such apparatus and supplies as they saw fit, not to exceed the total amount of $800,000. Inasmuch as there seemed to be a little doubt as to the necessity of the commission's contracts being approved by the Common Council, the commission decided to submit the contracts to the Council for approval, it being supposed that this would be a mere formality, and that the Council would promptly approve the contracts. Instead of this, the Council referred the contracts to their Lighting Committee, consisting of Councilmen Patterson, Goeschel and Welch. This committee went to Chicago and other places, and finally, early in March, reported to the Council that the contracts were all acceptable with the exception of the Western Electric Company's dynamos. The Council were prepared to approve all contracts except the dynamo contract, when in the midst of their Council meeting, on April 10, a communication was received by the the Council from the commission, citing a written opinion of City Counselor Speed to the effect that the approval of the Council was not necessary on the contracts which the commission had decided upon. The commission, therefore, withdrew from the consideration of the Council, all contracts which they had not as yet approved, which consisted of the dynamo contract and lamp contract. All other contracts had previously been approved and the lamp contract would have been immediately approved by the Council, but could not in the order of business come up for consideration until after the dynamo contract. The Council refused to confirm the dynamo contract, and it was then that the commission sent in the above mentioned opinion of the city counselor. The Council at once authorized their president to employ Professor Kent, or another competent attorney, to enjoin the commission from letting the contracts without their approval. It is generally believed by the citizens of Detroit that the commisson has full power to act, and the Council will not carry the matter further.

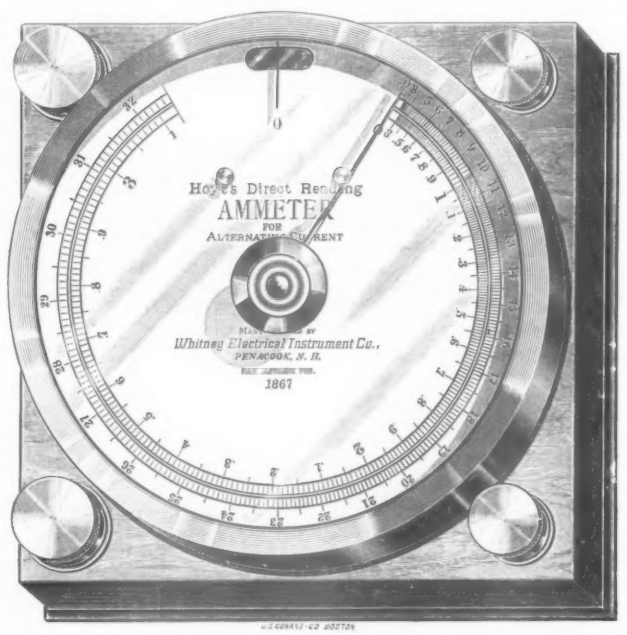
New Alternating Current Ammeter.

The instrument illustrated herewith is the latest production of the Whitney Electrical Instrument Company, and is of unusual interest to the trade from the fact that it is the first instrument of this description ever put on the market. It is the invention of Dr. A. H. Hoyt, electrician and general manager of the Whitney company, and is known as one of Hoyt's standard instruments.

It is designed principally for lamp and meter measurements on alternating currents. These instruments are made up both as ammeters or voltmeters, and the double scale ammeters of this type are particularly valuable, as the same instrument will make single lamp tests or full meter measurements. These instruments are direct reading, portable and specially adapted for lighting stations using alternating currents and for lamp manufacturers.

The armature works against a double spring torsion, similar to a dynamometer, and no leveling screws are necessary. The nominal position of both armature needle and index pointer is at zero. When the current passes through, the armature needle is deflected. The index pointer is then moved round until the needle is brought back to zero, when the correct reading will be indicated on the scale.

With the low reading instruments a reading may be taken to $\frac{1}{1000}$ of an ampere, and these readings are correct to one-half of one per cent. The instruments are made in various ranges to meet the demands of the trade, are handsomely mounted and can be used as a laboratory standard as well as for outside testing. The Whitney company are now preparing a new and revised catalogue, showing a full line of their instruments, which will soon be ready for distribution.



New Alternating Current Ammeter.

The Germania factory at Marlboro, Mass., has been sold to Bryan, Marsh & Co., of New York, manufacturers of incandescent lamps. The firm will take possession at once.

THE WHITE-CROSBY COMPANY.

AN ABLE ENGINEERING FIRM.

On May 1 the widely known electric railway contracting firm of J. G. White & Company, of New York city, changed its name to that of the White-Crosby Company, and moved its head offices to the Equitable building, Baltimore, Md. A New York office will be maintained in the old quarters of the firm, 29 Broadway, and a Chicago office has been established in The Rookery.

The officers of the company are J. G. White, president and general manager, O. T. Crosby, chief engineer, and George H. Walbridge, secretary and treasurer. Mr. White was graduated from Pennsylvania State College in the class of '82, and from the electrical engineering course at Cornell University in the class of '85, holding a fellowship during the last year. He was in charge of the department of Physics at Nebraska University during the next two years, and in 1887 formed the Western Engineering Company which was sold out in 1890 to the United Edison Company. At this time Mr. White resigned and organized the firm of J. G. White & Company. Mr. Crosby was graduated from the United States Military Academy at Brookhaven, Miss., in the class of '78, and served in the different engineering corps until 1887 when he joined the Sprague Railway and Motor Company, becoming its superintendent after a short time. At the end of two and a half years he began the Weems high speed electric railway experiments at Baltimore which attracted so much attention at the time and since. Mr. Crosby then connected himself with the Thomson-Houston Electric Company and lately has been in charge of the General Electric Company's railway department. Mr. Walbridge was graduated from the electrical engineering course at Cornell University in the class of '90. He was assistant superintendent for the United States Company at Newark, N. J., for a year, and then joined the firm of J. G. White & Company.

The New York office will be in charge of A. G. Greenburg, a Princeton graduate, who has been connected with the Thomson-Houston, Fort Wayne and Washburn & Moen companies. The Chicago office will be in charge of J. F. Easterbrook, a Yale graduate, formerly assistant engineer in the Chicago office of the Edison company.

With such engineering ability at its command, together with its strong personal following and its record to go upon, the ever-increasing success of the White-Crosby Company seems assured.

The Hull and Nantasket Street Railway Company is the title of a new company which has just been formed for the construction of a line from Pemberton Point to Hingham, a distance of five miles. The stock is capitalized at $14,000, and the incorporators include some of the best known local capitalists.

ELECTRIC RAILWAY NOTES.

The casualties on the Broadway cable road in New York city up to April 25, includes eight persons killed and 12 persons injured.

The Camden, Gloucester and Woodbury Electric Railway has filed a bond for $25,000 with the Woodbury, N. J., city council for the faithful performance of its contract.

Rapid transit for Boston is manifest destiny. But the embarrassment of choosing between two or three dozen kinds of manifest destiny is what is bothering Boston just now.

The gas and water company at Carlisle, Pa., objects to the Cumberland Valley Electric Passenger Railway Company building a trolley road in Carlisle for fear it will interfere with the gas and water company's rights in the streets.

The town of Lanesboro has offered to give $8,000 to the Pittsfield, Mass., Electric Railroad Company if the latter will extend its tracks to that town and operate the road for a certain number of years. It is thought the company will not accept the offer.

An electrical syndicate has just acquired possession of Terry's Island in the Connecticut River, and will erect a large power plant at that place. It is purposed to build a dam across the river and use this power for supplying the surrounding towns with electricity.

Baltimore, Md., is to-day probably the most active electric railroad center in the country. During the last two or three years about $15,000,000 have been invested in the construction of electric and cable lines, and about 80 miles of additional road are now under construction or will be built this Summer. Probably no other city in the United States can show such a record of activity and so many lines built and projected as Baltimore.

Chester, Pa., which is the most important center of population in the almost continuous line of villages between Philadelphia and Wilmington, is to have all the street railways connecting it with neighboring towns and cities consolidated under the management of a single company. This means the ultimate netting of a remarkably rich and prosperous semi-urban community with lines of communication that will subsequently make of a whole county essentially one city.

Mayor Vinal, of Middletown, Conn., has vetoed the petition of the Middletown Horse Railroad Company for an overhead trolley construction, and bases his objections on the ground that the company is not specific enough in the details of its plan, nor was the public hearing in accordance with the electric road act passed by the last general assembly. The street railway company immediately introduced a new petition covering every objectionable point, and another public hearing will be given on the 23d inst. The company is made responsible for all damages of whatever nature and the road must be completed by January 1.

The Paragon Speed Indicator.

The Metropolitan Electric Company, Chicago, have recently brought to the attention of the electrical fraternity the very ingenious speed indicator, illustrated herewith and known as the Paragon. This device possesses three important advantages: First, such a construction of the handle that the operator may be able to obtain a firm and steady grip on the instrument with one hand; second, ability on the part of the operator to start and stop the registering mechanism instantaneously with the same hand that is used for holding it; and third, the adaptability of the indicator to shafts or machinery turning in either direction.

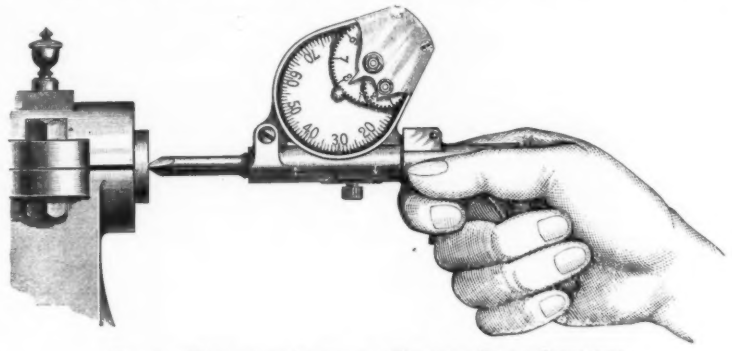


FIG. 1.—METHOD OF USING THE PARAGON SPEED INDICATOR.

Fig. 2 represents the Paragon speed indicator with a portion of the bearing in which the spindle revolves cut away so as to show the worm gear connections, and also to illustrate the ball-bearing at the inner end of the spindle, designed to sustain the end thrust when the device is in use. The letter H designates the handle, which is of pistol-grip form, S the spindle, which has its outer end angularly pointed and its inner end provided with a ball-bearing, B. F designates the frame in which the dial-wheels D^1, D^2, D^3 are mounted, and this frame is pivoted to the stock at P so that it can be moved downward on such pivoted connection against the force of a spring, to cause the teeth of the dial-wheel to engage with one of the worm gears on the spindle S. The letter D designates the dial-wheel which meshes into the worm gear, and is graduated to indicate units and tens of revolutions. This dial-wheel has a pinion which meshes with a dial-wheel D^2 indicating hundreds, which in turn actuates another dial-wheel D^3 indicating thousands of revolutions. This "thousands" dial will be found very useful in connection with such high-speed machinery as dynamos and motors.

The dials can be easily and quickly reset to their normal positions at zero by turning the thumb-nut (which will be found at the back of the dial frame F) until the star on each dial-wheel is opposite its respective pointer. The letter X designates the shifter slide, which carries with it the two worms, one right-hand and the other left-hand, which, though mounted to rotate with the spindle S, have a sliding movement thereon controlled by the shifter X. This shifter may be pulled to the right or left, according to the direction in which the shaft is running, as indicated by the letters R-L on the slide, thereby revolving the dial-wheels always in the same direction, thus avoiding confusion in reading the result by having only one set of figures.

The letter T indicates the trigger-form lever, by pulling which the dial-wheels are brought into operation, and which, in combination with the pistol-grip handle H, gives the instrument its accuracy.

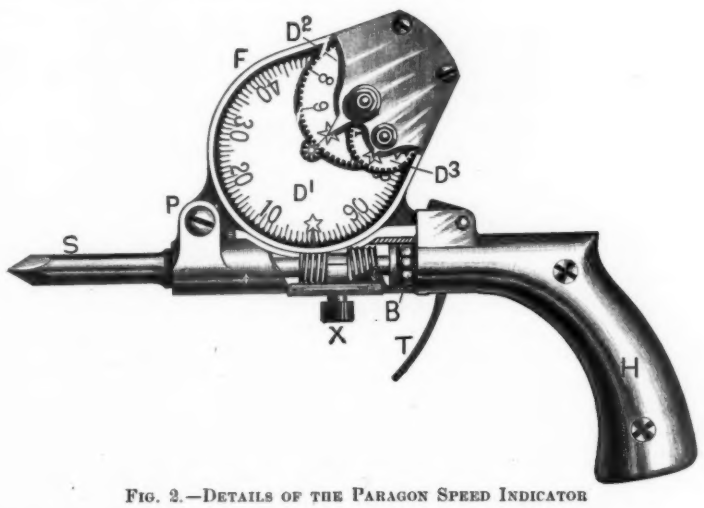


FIG. 2.—DETAILS OF THE PARAGON SPEED INDICATOR

The watch is held in the other hand, and at the moment the second-hand reaches a convenient point and the shaft is running at its full or normal speed the trigger is pressed and the registering mechanism instantly brought into action. When the second-hand shall have completed its circuit the trigger may be released, which as instantaneously disengages the registering mechanism even though the spindle continues to revolve. An accurate registration is in this way obtained without so much as looking at the instrument after it is once applied until after it has been removed.

The Nassau Electric Railroad Company.

Chas. D. Shain, eastern agent for the Siemens & Halske Electric Company, of America, has captured the contract for the generators which will be required by the Nassau Electric Railroad Company, of Brooklyn, N. Y. The first order is for about 2,200 horse-power.

The Nassau company has also awarded a contract for 60 car equipments, consisting of two 30 horse-power motors for each car, to the Steele Motor Company, of Cleveland, O., motors to be delivered so that cars can be running July 15.

The Steele Motor Company is practically owned by the Johnson company, of Johnstown, Pa., and the Johnson company is building the Nassau street railway. Further contracts for 120 motors will be immediately placed.

It was announced in Brooklyn last week that the signing of the contract for the construction of 100 miles of new trolley lines for the Nassau Electric Railroad Company will reopen the fight against the P. H. Flynn syndicate begun by William J. Gaynor and Edward M. Grout, and that all the old allegations of scandal will again be aired.

Lawyer Edward M. Grout is watching the railroad company with a view, it is said, of beginning an action in court as soon as ground is broken on certain portions of the proposed route. Work has already been begun on the Thirty-ninth street branch, and this week it is expected that 600 men will be put to work on the other lines.

As soon as this is done by the Nassau company it is said that application will be made for an injunction restraining the Flynn syndicate from constructing the roads. The injunction will be asked on the ground that the 13 members of the old Board of Aldermen illegally granted the franchises.

By Trolley From Newark to Jersey City.

The electric railroad between Newark, N. J., and Jersey City, was opened at 5.30 o'clock A. M. April 21, and regular trips under 10 minutes' headway were begun. The cars will run until 1.15 o'clock at night, the last car leaving the Jersey City ferry at that time. The Consolidated Traction Company has completed arrangements by which the round trip from Newark to New York will be made for 20 cents, which is five cents cheaper than the present excursion rate on the railroads. The excursion tickets will not be sold till the end of this week.

QUESTIONS AND ANSWERS.

BY OUR "QUESTION EDITOR."

TO THE EDITOR OF ELECTRICAL REVIEW:

Kindly inform me what the Blake, Berliner and Edison patents are on the transmitters manufactured by the American Bell Telephone Company and when issued.

L. R. ROBERTSON.

Portland, Ore., April 10, 1894.

I must respectfully suggest that Mr. Robertson consult a patent attorney.

ALTERNATING CURRENT RESISTANCE.

A QUICK AND PRACTICAL METHOD TO DETERMINE THE EFFECTIVE RESISTANCE OF CIRCULAR CONDUCTORS CARRYING ALTERNATING CURRENTS.

In a memoir, contained in the *Philosophical Magazine*, 1886, Lord Rayleigh published a formula for calculating the effective resistance of circular conductors traversed by alternating currents of a known frequency. However, his table is neither accurate for the larger sizes of wires nor for high frequency. In fact, it can only be employed within very narrow limits. Later on Sir Wm. Thomson calculated a table for conductors of given diameter traversed by a current of 80 alternations per second. Quite recently, M. Hospitalier, in *L'Industrie Electrique*, has published a method for quickly determining the resistance of any conductor traversed by a current of known frequency.

Let R_A denote the resistance of a conductor of circular cross section when traversed by an alternating current.

Let R_G denote its resistance when employed as a continuous current conductor. In this case,

$$R_A = KR_G \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

In this equation, k is a numerical co-efficient, depending first upon the frequency $\frac{1}{T}$ and the diameter d, of the wire. We know from Thomson's above-mentioned researches, that with a wire of specified material, the factor k remains unchanged for any value of the product

$$d^2\left(\frac{1}{T}\right)$$

consequently we can calculate a table which determines the value of the frequency for each value of the product of the square of the diameter by the frequency.

In the subjoined table the diameter of the conductor is expressed in centimeters, and the frequency in seconds. It is futhermore assumed that copper is used, whose specific resistance is 1,597 C. G. S. In order to find the value of k, by which the resistance R_c of a conductor of d (centimeters) diameters should be multiplied, it is sufficient to determine the square of the diameter with the frequency per second, then search the corresponding column for the value which most closely approximates k, and apply Equation 1.

The values of the increase of co-efficient k for copper conductors of circular section of diameter d (centimeters), traversed by alternating currents of frequency $\frac{1}{T}$ per second, are as follows:

$\frac{d^2}{T}$	K
0	1.0000
20	1.0000
80	1.0001
180	1.0258
320	1.0805
500	1.1747
720	1.3180
980	1.4920
1,280	1.6778
1 620	1.8628
2.000	2.0480
2 420	2.2190
2 880	2.3937
5.120	3.0956
8.000	3.7840
18 000	5.5732
32.000	7.3250

Numerical application: What is the resistance of a copper conductor of two centimeters diameter traversed by a current of 80 alternations, its electrical resistance, measured by a Wheatstone bridge, being three ohms?

We find:

$$d = 2,\ d^2 = 4,\ \frac{1}{T} = 80\ \frac{d^2}{T} = 320$$

Referring to the table, it will be seen that the correct value of k is 1.0805; consequently:

$$R = K R_G = 3 \times 1.0805 = 3.2415\ \Omega$$

If the product $\frac{d^2}{T}$ is not given in the table, the next higher value may be chosen; the above data enable us to determine the value of R_A sufficiently accurate for all practical purposes, because the table gives for the frequency 150 (which frequency is seldom surpassed in practice) the value of k up to 15 centimeters diameter. In practice, however, a wire of such diameter is not employed.

If the product $\frac{d^2}{T}$ exceeds 32,000, we find the corresponding effective resistance very accurately by calculating that of a flat conductor, assuming its cross-section to be equal to a tubular conductor of the same exterior diameter and of the following thickness:

$$6.38\ \sqrt{T\ cm}$$

As stated above, all calculations are based upon pure copper, having a specific resistance of 1,597 C. G. S. units, for a metal whose specific resistance c is different from that of pure copper, and whose magnetic permeability equals one (exclusive of iron and steel), the quotient $\frac{d^2}{T}$ by means of which we find the value of k in the table, must be multiplied by the quotient of the specific resistances of copper and the metal under consideration, *i. e.*:

$$\frac{1597}{c}$$

Of course, these equations do not take into account either capacity or mutual induction, but they enable us to judge quickly in any given case whether the factor k may or may not be neglected.

Lien Against the Card Motor Company.

A mechanics' lien was filed on April 11 by Jas. Griffith & Sons, building contractors, against the Card Electric Motor and Dynamo Company, of Cincinnati, O. The lien is for $17,208.64, and attaches to the property of the Card company at Hunt and Broadway. The claim is for the balance due on the contract for putting up the new building. It will be recalled that a part of the walls fell down and there was loss of life, and a controversy has arisen as to whether the owners or the contractors shall stand the loss.

THE ELECTRIC RAILWAY.

A LECTURE IN THE COOPER UNION ELECTRICAL COURSE DELIVERED BY T. COMMERFORD MARTIN.

(*Continued from page 204.*)

Thus it came to pass that Tariffville was to have a first-class modern trolley road with all the latest trimmings and appurtenances. The first thing that Mr. Vance had to determine was the size and location of his power plant for about 30 cars. He hoped at first to use the water-power that had made Tariffville and had kept its factory wheels going so many years, but he soon found that it would not do. The mills had taken up most of it; besides in Summer there was always low water from drought, and in Winter the bother from needle ice and anchor ice was serious. A mill could shut down even for a whole day and nobody cared except the operatives; but if a street railway got stalled for fifteen minutes everybody knew it and kicked about it, particularly those who didn't ride once a week. So he decided to put in a steam plant near the railroad track, in order that the coal could be run into the station on a short switch. He figured that on busy days he could keep 40 cars going and he thought that an average of 15 horse-power per car for motor cars and trailers would be about the thing. That would make roughly 600 horse-power needed in the station, but as he expected a steady growth of the town and a rapid growth of traffic he equipped for 750 horse-power. He was tempted to put in one or two big dynamos driven directly by the engines, like those he had seen at the World's Fair, but he was afraid to get all his eggs in one basket, and real estate was not extremely dear; so with plenty of elbow room he decided on putting three 250 horse-power compound engines belted to a long heavy line of shaft to which were belted six 500 volt dynamos or generators of 150 horse-power each. You may have noticed that when a machine gives current for lighting it is called a dynamo, and when it gives current for power it is called a generator. The only real difference you will be able to discover is that generators seem to cost more than dynamos, so I don't blame manufacturers of railway generators for sticking to the different names. Mr. Vance bought the best generators he could get and had the satisfaction of having a compact flexible plant, any part of which, almost, could be used without reference to the others. Of course, he installed water tube boilers, putting in five units, of a type that would steam quickly, as the strain that comes on a road is often very sudden, and then the engines make heavy demands on the boilers. This plant was put in a solid brick building, under an iron roof, and when it was up Mr. Vance very soon began to lose his interest in the state of the horse market and the price of oats.

While the power plant was a-building work went on very actively along the line, which ran about five miles each way from the central power house, it happening very fortunately that the electrical center of the system coincided with the most suitable point for the station. Two very important features had to be considered, first, the overhead construction, and second, the track. At first, Mr. Vance was inclined to use center pole construction in the city district. The streets were rather wide and he thought a line down the center would look trim and neat and avoid tree cutting. But on inquiry he found that the wires hanging from the center poles were more rigid than those carried between poles each side of the street, so that insulators were constantly knocked off, and trolley poles frequently got caught in the line. Besides, passengers would hang their arms and heads out, and if they got hurt, refused indignantly to believe for a moment that it was their own fault. Such accidents had been frequent, he ascertained, in cities where the center pole had been insisted on; in fact, half the cry against the "deadly" trolley should have been against the "deadly" center pole standingin a too narrow space between the up and down tracks. Hence, Mr. Vance, as the city council had wisely left the matter to him, put in iron poles along the curb in the city, and in the suburban district, poles of wood. The iron poles were in sections, stood about 20 feet above street level, and were set about 6 feet in the ground. The poles were usually about 125 feet apart. Between these poles, across the streets, were strung No. 1 B. & S. span wires of Swedish iron, and from these spans, the trolley service wires was suspended by means of insulator clamps or insulator holders. The trolley wire was No. 0. As guard wires had been insisted on, it was necessary to place above the trolley wire spans, guard wire spans which carried a rather heavy galvanized iron wire. In most cases these guard wires, which are supposed to keep off broken telephone and telegraph wires from the live trolley wire, have created the very dangers they are supposed to prevent, and it was deemed prudent to cut them into frequent separate sections. The whole line was braced, guyed and anchored, with careful work on curves and turnouts, the overhead structure for such parts closely resembling in miniature that on the track below, but turned upside down. When all was done, every fixture needing it was carefully painted to prevent rust.

Having the line up and the power house ready, the object for Mr. Vance now was to get current from one to the other in the most approved manner. This was done by cutting the trolley line into independent sections and running a feeder to the point which we may call the center of distribution for each group of trolley sections. By this means two ends were accomplished. Had the current been fed in at only one or two points on the line, the difference of potential or "drop" in voltage would have been considerable, and loaded cars far away from such feeding points could not have got volts enough for their motors. But with these sectional feeders, the potential was kept equal within a very small percentage all over the trolley line. The other main features of advantage thus gained was that in case of a fire, or a procession blocking one section, all the other sections could be operative either side of it. These cable feeders had, in Mr. Vance's case, to be put underground, but if you go over to Brooklyn you can see them festooned along the trolley lines in a very ugly fashion. Why Brooklynites have it that way, I don't quite understand, seeing how earnest they are about reform with a big R.

(*To be continued.*)

Electric Lightships in Russia.

Even Russia is making progress in electric lighting, the government of that country having recently placed a new lightship off the Port of Libau, about six miles from the shore. The vessel is provided with a powerful electric light which can be seen better than the lighthouse light.

General Electric Company's New Offices at Chicago.

The recent removal of the Chicago offices of the General Electric Company from the old Edison general offices at 173 Adams street to the Monadnock Building was due to a conclusion reached several months ago that more room was required for the large stock of goods that this company carry, and better facilities for making shipments. The new storehouse is located on the line of the Wisconsin Central, Chicago and Great Western and Baltimore and Ohio railways, and is splendidly situated for shipping purposes; the company is, therefore, in shape to make even prompter shipments than heretofore.

The removal of the stock to this new storehouse left the Adams street building partially vacant, and other quarters for office purposes were sought, arrangements finally being made for a portion of the 10th floor of the Monadnock Building. The rooms occupied, 1042 to 1056 inclusive, take up the whole of the south end and are fitted up handsomely, so that they now have one of the finest suites in the building, which means one of the finest in Chicago.

FIG. 1.—CHICAGO STOREHOUSE OF THE GENERAL ELECTRIC COMPANY.

FIG. 3.—INTERIOR VIEW OF THE GENERAL ELECTRIC COMPANY'S OFFICES IN THE MONADNOCK BUILDING, CHICAGO.

Entering the offices from the hall, the accounting department, credit department and cashier are on the left, occupying offices partitioned off in quartered oak on the east side of the building.

The offices being so high up are lighter and freer from noise, dirt and smoke than the old offices nearer the street; and from the windows is had a magnificent view of the city. The swift running elevators bring the 10th story within easy reach of the street. The Monadnock Building is becoming known as the electrical center of Chicago.

INTRAMURAL CARS FOR BROOKLYN.

WORLD'S FAIR PASSENGER COACHES TO RUN TO CONEY ISLAND.

It was announced last week that the Atlantic Avenue Railroad Company, of Brooklyn, N. Y., has purchased three of the motor cars used on the intramural elevated electric railway at the World's Fair last year. The cars were purchased a month ago by President Norton at a cost of $4,000 each. The bodies and trucks of the cars were shipped several days since, and are expected at any time.

All three will be remodeled to the extent necessary to operate them as trolley cars, and they will be used as an express service to haul open cars from Thirty-ninth Street Ferry, Brooklyn, to and from Coney Island, and will obviate the employment of locomotives as formerly.

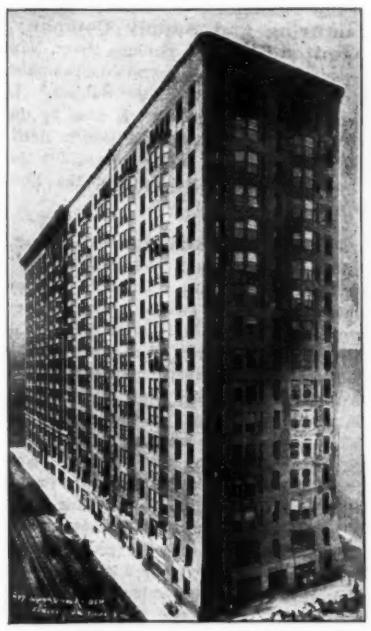


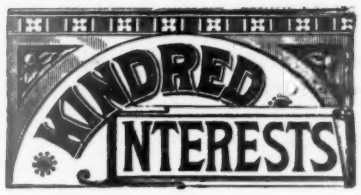
FIG. 2.—MONADNOCK BUILDING, CHICAGO.

The motors to be used are now at the Schenectady shops of the General Electric Company, and are expected to be ready for shipment to Brooklyn this week.

The cars have each a seating capacity for 90 passengers, and, in addition, will be arranged to draw four open passenger cars of equal capacity. On Transportation Day at the Fair one of these motor cars easily pulled a train of 12 others.

The company's new acquisitions are equipped with automatic brakes, and the absence of cinders and smoke will do away with the disagreeable features of the system now in vogue.

The cars will be put in service shortly before the opening of the regular season, and if they are found to answer the purpose it is probable that additional purchases will be made by the company.



The General Electric Company has sent the ELECTRICAL REVIEW a handsomely bound double indexed diary. It is practically perpetual, no year date being used, and makes an attractive and effective advertisement.

The Love Spanish and South American Electric Traction Company has issued a very handsome and interesting illustrated pamphlet entitled "Tracción Eléctrica," in which the Love system of traction is described.

The Wyckoff Pipe Company, Williamsport, Pa., have the contract for furnishing and laying the conduits for the feed wires of the Philadelphia Traction Company, and they are also furnishing the tubing for the feed wire conduits for the Electric Traction Company, of Philadelphia.

The Southern Electrical Manufacturing and Supply Company, Limited, 110 to 114 Baronne street, New Orleans, La., has issued a neat little pamphlet entitled "More Light on the Subject." It contains a record of the work done by the company and numerous flattering testimonials. This company is agent for the General Electric Company and the Fort Wayne Electric Company.

The Stock Exchange Building, Chicago, is the latest to adopt "Xntric" switches throughout. The Old Colony building has these switches also, and they are found to be entirely satisfactory. The Metropolitan Electric Company feel the preference as being very important, when it is considered that the "Xntric" switch has only recently been put on the market, and is so successful in meeting competition. N. I. R. wire is being put into the Leland Hotel, the famous old hostelry at the corner of Adams street and Michigan avenue. This wire is becoming prominently known in the West and some of the largest "Sky-scrapers" in Chicago have been wired with it. The Metropolitan Electric Company are the general western agents and carry a complete stock.

The New Electric Light and power station for the Brush Electric Light Company, at Baltimore, Md., will be one of the finest in the Southern States. The boiler room is 83 feet wide by 129 feet long. The dynamo room is 180 feet square. The floor space in the latter is entirely free from posts. The roofs are designed and built by the Berlin Iron Bridge Company, of East Berlin, Conn., and are made entirely of iron, covered with their patent anti-condensation corrugated iron roof covering. J. F. Rogers & Company, of New York city, have placed the order for a new industrial school building at Havana, Cuba, with the Berlin Iron Bridge Company, of East Berlin, Conn. The building will be 15 metres wide and 48 metres long, constructed entirely of iron and cement.

Alternate Current Measurement.—Owing to the rapidly growing amount of alternate current working, the demand for instruments to measure the strength of alternating currents has increased enormously in the near past. Although there have been many improvements in the measurements of voltage and power, no radical changes have been found necessary since the invention by Siemens of the dynamometer which bears his name. It to-day remains the standard, and with the exception of the Thomson balance, the only reliable instrument for the measurements of alternating current strength. Many minor improvements have been made upon the instrument, chiefly in the laboratory of Queen & Company, Philadelphia, who are the sole American manufacturers. By mentioning the ELECTRICAL REVIEW, a new catalogue will be sent you by that company.

PROPOSALS FOR MISCELLANEOUS ARTICLES. Office of the Lighthouse Engineer, Third District, Tompkinsville, N. Y., April 28, 1894.—Sealed proposals will be received at this office until 12 o'clock M., Monday, the 14th day of May, 1894, for furnishing miscellaneous articles for the lighthouse establishment. The articles needed consist of 19 numbered lots, embracing, respectively, charcoal; building material; engineers' supplies; hardware, tools, etc.; iron and steel; belting; graphite paints, etc.; lumber; brick; plate glass; galvanized and Russia sheet iron, tin, solder, sheet zinc and iron wire; sheet brass and copper, bar copper, brass rod and tubing; composition, brass, and nickel castings; acids, iron castings; sheet-iron smoke-stacks for boilers; electro-plating supplies; shooks for oil supply boxes; and miscellaneous articles; all of which are enumerated in the specifications attached to the form of bid, which may be obtained on application to this office. Samples may be seen or information obtained at this office concerning any article not sufficiently described in the specifications. Bids will be received for one or more numbered lots complete. Envelopes containing proposals should be endorsed "Proposals for Miscellaneous Articles." The right is reserved to reject any or all bids, to strike out any item or items in the specifications, and to waive any defects. The right is also reserved to require the delivery under the contract of a greater or less quantity of any item mentioned in the specifications other than quantities therein specified. Bidders are invited to be present at the opening of proposals. D. P. HEAP, Major of Engineers, U. S. A., Engineer Third Lighthouse District.

PROPOSALS FOR LIGHTING.

SEALED PROPOSALS for lighting the streets of the City of Williamsport, Pa., for a period of five years from Dec. 1, 1894, with electricity, gas, or otherwise, will be received at the office of the city clerk up to 12 M. of Monday, April 30, 1894. Bidders will state plainly the kind of lights, number, location and candle-power of the same. Said lighting is to be for every night in the year from dark to daylight. Each bid must be accompanied by a certified check for one thousand dollars. The city reserves the right to reject any or all bids.

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